ANNUAL REPORT

OF THE

DEPARTMENT OF AGRICULTURE

BOMBAY PRESIDENCY

FOR THE YEAR 1916-17

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No. 8302 OF 1917.

From

THE HONOURABLE MR. G. F. KEATINGE, C.I.E., I. C. S.,
Director of Agriculture, Bombay,
Poona;

To

THE CHIEF SECRETARY TO GOVERNMENT,
Revenue Department,
Bombay.

Poona, 30th September 1917.

Sir,

I have the honour to submit the Annual Report of the Agricultural Department for the year 1916-17.

CHAPTER I.

ADMINISTRATIVE.

2. During the year the expenditure of the Department amounted to Rs. 8,50,000 as against Rs. 8,21,000 of the year before and Rs. 8,53,000 of the year before that. The expenditure during the past three years may therefore be regarded as stationary. There was an increase of Rs. 25,000 under the heading "Salary and pay," mainly due to the system of progressive salaries and the fact that most of the staff are still in the junior ranks. The departmental receipts were Rs. 1,53,000 as against Rs. 1,30,000 the year before. A contribution of Rs. 4,000 was received from the Sir Sassoon David Trust Fund towards the cost of the Vernacular Agricultural Schools at Loni, Devi-Hosur, Mirpurkhás and Jámbul, and the famine fodder storage operations. The permanent advance of Rs. 40,000 for the purpose of financing quasi-commercial transactions was very fully utilized, and an increase of the sum has been asked for.

3. Two of the three Deputy Directors—Messrs. Henderson and Gilbert—were absent throughout the year, and their posts were held by Mr. P. C. Patil and Ráo Sáheb M. L. Kulkarni. The Extra Deputy Director, Mr. Gonehalli, was again absent on deputation throughout the year and his post was held by Mr. V. G. Gokhale. The other incumbents of the upper ranks were present throughout the year except for short periods of privilege leave. Of the European members, however, Dr. Burns has had his time much taken up by duties in connection with the Indian Defence Force, and others have had their time more or less occupied in the same way.

4. In the lower ranks we have had rather severe casualties due to demands for our staff from other localities and organizations. Two of our staff left to take agricultural service under Native States, one to take an agricultural post under the Tálukdari Settlement Officer, one to join the Educational Department, one to join the Co-operative Branch, one to take up sanitary work connected with water analysis, one to join an acetone factory and one to join a projected sugar-making concern. The men who get such offers are naturally amongst the most competent of our staff, and such an exodus throws a strain on a young Department. We are, of course, glad to be of assistance to others and to secure good prospects for our men, but it must be recognized that our resources in this respect are limited, and it is unlikely that in the near future we shall be able to meet in full the similar demands which have already been made or which are likely to arise.

5. From the administrative point of view the most important developments during the year consist of the opening of a new agricultural station at Kumta (Kánara) and of a new agricultural school at Jámbul (Thána), and the appointment of a Second Economic Botanist for the purpose of plant breeding. The natural and considerable development of the existing lines of work, accompanied by a practically stationary budget, has thrown a strain on the staff, and in particular on the supervising staff. The Northern Division, in particular, forms a

most unwieldy charge in view of the work that has developed there, and it is hoped that some relief may be possible in this and in several other directions in the near future.

CHAPTER II.

SEED.

6. *Surat Farm cottons.*—In the vicinity of the Surat farm 895 acres were sown with our selected strains, as usual. The outturn worked out at 360 lbs. per acre, and the cultivators got Rs. 11 per bhár more for the cotton from our seed than for ordinary Surat cotton. This represents an increased value of rather over Rs. 4 per acre, or a premium of 7 per cent. The valuations of the last five years indicate that the true premium should have been 13 per cent. Ten bales of a selection for quality, marketed in Liverpool by the purchaser, realized a very good price which I understand showed an advance of about Rs. 200 per khandy on ordinary Broach, but the conditions of the market during the past year were such that it would probably be unsafe to regard this as a normal indication of value.

7. *Sind-American cotton.*—A reference to paragraph 6 of last year's report will show how the matter stood before this year. In order to make sure that the seed distributed was pure, no seed was distributed except that grown on our seed farm. The amount of cotton produced was consequently very small. The Bombay Syndicate which resumed its operations bought American cotton equivalent to 176 bales, and I understand that Messrs. Ralli & Company bought cotton equivalent to 40 bales. The crop was badly affected by wet weather in August and round Mirpurkhás was very poor. The price paid for the American cotton gave a premium of 23 per cent. over the price paid for *deshi* cotton, and a few larger zamindárs obtained a price that gave a premium of 33 per cent. This is a distinct improvement on the premium obtained during the previous year. The quality of the cotton was, however, declared by the Syndicate to be poor and the staple uneven, and the price paid was about the current price for ordinary Broach cotton. It is difficult to account for the falling off in quality during one season, after the quality had been maintained for four years. It may have been due to the unfavourable season or possibly to substituting roller ginning for saw ginning. We must clear up the matter in future years. During the current year it has not been possible to sow American cotton in Sind, since the Jamrao Canal was not working at sowing time. In view of the quality of the cotton received and the small production I understand that the Syndicate do not wish to continue buying operations. For the moment therefore the growing of American cotton in Sind ceases to have a commercial aspect. I have little doubt, however, that there is a future for it, though sustained botanical work may be necessary. Given a canal that will work throughout the year the physical conditions in Sind seem to be suitable, though the economic conditions are difficult.

8. *N. R. cotton in the Deccan.*—The work in connection with this cotton extended, and 290,000 lbs. of seed were distributed. Its popularity continues, and the cultivators have no difficulty in realizing the true value, since its advantage lies in quantity. To facilitate the extension of this seed-distribution work seven Seed Societies have been formed.

9. *Cottons in the Southern Marátha Country.*—Broach and Cambodia cottons are still sown on a fair scale, and the area under the latter tends to increase. Both continue to fetch very good prices as compared with Kumta cotton, but for the reasons previously stated they are not likely to have an extended success. Prolonged botanical work on them will probably alter the situation. Meantime we are devoting ourselves to a selected Kumta strain and for the Dhárwár-American tract to a strain of Upland American cotton. The advantage of these cottons over the local ones is about 20 per cent., mainly in the direction of quantity as denoted by ginning percentage, though the quality also is superior to that of the local cottons. The seed is now being reproduced on a large scale and we shall have a good deal to distribute next year.

10. The value to the cultivator of superior strains is largely bound up with the question of marketing. The matter has been dealt with at length in previous years, and the difficulty is still unsolved. Enquiries made during the past year indicated the very extensive and fraudulent mixing of long and short stapled

cotton that goes on everywhere and at all stages in handling cotton, and this no doubt partly accounts for the insensitiveness of the market to any alleged superiority in staple. We are trying to solve the difficulty by the formation of Cotton Sale Societies, one of the aims of which will be to establish a reputation for supplying cotton of good quality and for honest dealings. A fair start has been made, but it is too early yet to say how the matter will work out.

11. As an example of the difficulty that occurs in deciding between long and short stapled cotton I may mention a problem that has occurred during the past year. Some years ago we distributed in the Broach District seed of our Surat strains, the quality of whose lint was admittedly superior to that of ordinary Broach cotton, and the cultivators who sowed the seed expected to get a better price for their seed cotton. As a matter of fact they got a less price because the ginning percentage is less, and the Broach market buys on a consideration of ginning percentage and not of the quality of the lint. Seeing this we set to work to repair the error and started selecting from the Goghári hybrids grown in the Broach District strains with a high ginning percentage, and we have selected some good ones. The cultivators are anxious to have seed of these strains and the buyers of seed-cotton will pay high for the produce, but the Cotton Trade Association of Bombay has protested against our distributing them since the staple of these is inferior to that of Broach *deshi*. Thus, the cultivators refuse to sow what the mill-owners want, and the mill-owners object to the cultivators getting what the buyers of seed cotton will pay for. The difficulty is caused by the fact that the local market is sensitive to quantity but not to quality. The mill-owners may want quality, but it is the local buyer of seed-cotton who dominates the situation. I understand that a Committee is to sit to go into questions of long and short stapled cotton, and it is to be hoped that they may do something to solve the difficulty.

12. In other directions the distribution of seed has continued on the same lines as in previous years. Mass selection, varietal trials and experiments in change of seed are now giving definite results. Thus mass selection in rice and jowári gives marked results, as will be seen from the appendices. Párner wheat, Akola bájri and Sátára groundnuts give a distinct advantage when taken to other localities, but the seed requires renewing at comparatively short intervals if the advantage is to be maintained. A 10-month Java sugarcane is now being grown in the Deccan on a large scale and promises to compete with Pundia, and two varieties of Mauritius cane are giving good results in the Konkan. Groundnuts of many varieties have now been introduced and adopted so widely that this work needs little pushing now. Very marked results have been obtained both at Poona and at Dhárwár by eliminating light seed from cotton seed.

13. Pure line selection in wheat and jowári has been conducted for some years, but definite results have not yet been obtained. Now that an officer has been appointed for plant breeding we may hope for progress in this line. He proposes to begin operations on rice and wheat.

CHAPTER III.

General Farming Matters.

14. Working on the principle that one of the most important lines of agricultural progress in this Presidency lies in the direction of better tillage, and that this is dependent on better implements and better teams, we have continued and extended our implement and cattle campaign.

15. The sales of improved implements during the year as reported by the different officers amount to—

	Rs.
Professor of Agriculture	34,800
Deputy Director, Northern Division	19,600
Deputy Director, Southern Division	38,300
Total ..	92,700

In Sind and the Konkan improved implements are less in demand, but are now finding an increased sale, so that the total sales may now be taken at about

Rs. 1 lákh per annum. This, of course, is exclusive of private sales by manufacturers and dealers, which cannot be estimated, but the figures given indicate the considerable revolution in tillage methods which has taken place during the past ten years. Iron ploughs are now freely used in most localities and are producing a marked effect. During the year the import of ploughs from England was limited by freight difficulties, but the deficit was made up by an increased import from America and by an increased sale of locally manufactured iron ploughs.

16. As regards cattle a definite policy for their improvement has now been sanctioned consisting of

(1) the establishment of bull-breeding farms for the best breeds and the issue of good bulls as "premium" bulls,

(2) the establishment of local reserves of fodder as a protection against famine,

(3) the holding of single-village shows.

Some progress has been possible in these directions. Proposals have been made for the establishment of a bull-breeding farm for Mysore cattle in the Dhárwár District, and I hope that a beginning will shortly be made. Enquiries have also been made in the Sholápur District, and a suitable site in Sángola has been provisionally selected, with regard to which I hope to make definite proposals before long. Premium bulls will now be issued of the Kankreji and Khillári breeds to suitable breeders, the Kankreji bulls being supplied from the Chhárodi farm and the Khillári bulls being purchased at fairs until such time as we are able to breed our own bulls.

17. As regards local fodder reserves, the machinery for shredding and baling *kadbi* at Kopargaon has now worked for a year. The complete plant erected at Kopargaon cost Rs. 18,000. It breaks up coarse *kadbi* very nicely and reduces it to a state in which the cattle will eat it with practically no waste. The *kadbi* so broken up is compressed into bales measuring 28″ × 18″ × 14″, weighing 55½ lbs. The cost of shredding and baling amounts to annas 2 pies 5 per bale. The effect of shredding is to reduce the *kadbi* to a far more eatable form than that in which it originally was, while the baling makes it much easier to handle, store and transport. It is too early yet to express any opinion about the keeping qualities of the fodder in these bales, but I have every expectation that it will keep in good condition for years together. At Kopargaon we are growing our own *kadbi*, and since the farm has only recently been broken up and is not yet in a good state of tilth the outturn of fodder there has not yet been large, but it will improve in the course of a few years. As soon as machinery can again be obtained from England I hope to get another plant of the same kind and locate it in the tract to the south of the Presidency (probably at Karajgi) where *kadbi* can normally be bought at very cheap rates, and start a store of shredded and baled *kadbi*, the raw material for which will be purchased locally. There ought to be a good future for such operations in tracts where *kadbi* is plentiful and cheap, such as the Dhárwár District and Upper Sind.

18. At Chhárodi 10½ lákhs lbs. of good hay has been cut and stored as a local fodder reserve. This was cut, stored and hand-baled by a contractor at a cost of Rs. 3-12 per 1,000 lbs. in a Dutch Barn which cost Rs. 5,000 to erect. Land has now been cleared and levelled for mowing machines which will in future be used and the hay will be collected by bullock rakes and stacked unbaled. During the first year, therefore, the storage at these two centres has amounted to 470 tons of hay at Chhárodi and 150 tons of shredded *kadbi* at Kopargaon. This will be added to yearly and should form a valuable local reserve of fodder when the next fodder famine occurs. I have marked down another grass area in the Kaira District for grass storage work, and if funds and staff are available I hope to be able to establish a third storage station there next year, for experience shows that the Nadiád Farm which was formerly proposed as a fodder storage farm is unsuitable.

19. The third line of action in connection with cattle is the single-village cattle shows. Arrangements have been made to hold a series of these next cold weather in the Ahmedabad and Sholápur Districts in the tracts where it is proposed to issue premium bulls.

20. The question of manure stands thus. There is considerable scope for chemical manures for the more valuable irrigated crops. Some of these manures are now unobtainable, and others only to be had at a greatly enhanced cost. When normal conditions return the matter will be pushed. Green manuring continues to give excellent results for irrigated crops, but for rice it is difficult to adopt in the conditions of this Presidency, and its results are not always satisfactory. The results that we have obtained stand in need of more interpretation than we have been able to give them. The detailed work done in this connection in the Madras Presidency demonstrates the complexity of the problem. For waingan (i. e., hot weather) rice, however, the results have been consistently satisfactory. The application of bulky manures, such as rice hulls and mhowra refuse, to rice continues to give marked and satisfactory results, and the residual value of mhowra refuse on the Alibág Farm is marked. For the dry-crop areas which form the great bulk of our cultivated lands, the mainstay in the matter of manure must continue to be farm-yard manure. The methods of treatment of this by the cultivators leave much to be desired, and we must aim at improvement in this direction; but if the supply is to be materially increased it can be done only by keeping more live-stock, and it seems to me that a departure in the direction of mixed farming is clearly indicated in some tracts. If this is to be possible the animals kept must, of course, be profitable ones and not mere dung-producers, as so many of them are at present, and we shall have to overcome the fundamental difficulty which the present size and distribution of the land-holdings presents; for the existing conditions of scattered holdings and congested villages almost preclude the idea of mixed farming. I have dealt with this matter at length in a separate report and hope that it may be possible to take the first steps towards ameliorative action, but I do not propose here to refer further to the matter except to express the opinion that it is hardly possible to effect any substantial improvement of farming methods and results in the case of a very large proportion of the cultivators unless this initial economic obstacle can be surmounted.

21. To revert more directly to the subject of manure, I wish to refer again to the extraordinary effects produced by an application of crude night-soil in tracts of good rainfall. The matter has often been mentioned before, but the figures for the past season given below may be considered to justify a further mention of the matter. On the trial plots at Broach the non-manured plots gave 264 lbs. of seed-cotton and the manured plots 1,108 lbs.; at Jalgaon the non-manured plots gave 213 lbs. of seed-cotton and the manured plots 987 lbs. In each case the outturn was increased more than four-fold. There is no doubt that crude night-soil has a most remarkably stimulating effect on cotton, though it is not easy to state with confidence the way in which it works. At Surat the effect on jowári was to increase the grain from 1,055 lbs. to 1,808 and the fodder (kadbi) nearly six-fold. Seeing that this is a manure the residual results of which extend over a number of years it must be agreed that the possibilities which it indicates are very great. At present crude night-soil is available only in municipal towns, but our propaganda has caused a keen demand for it where it is available. Until cultivators are sufficiently keen to secure the supply of this material from the villages the general situation will not be materially affected. Meantime it is unfortunate that the Sanitary Department is opposed to this use of crude night-soil and favour incinerators and other methods of disposal. No doubt, they are correct from the strictly sanitary point of view, but the matter has also a very important agricultural bearing.

22. Another important matter with which I have dealt in separate reports is the question of controlling the surface wash on undulating land and the prevention of the excessive soil erosion which now takes place yearly. Work of this nature is now in progress and the results are promising so far as they go. I have made proposals calculated to expedite the tackling of the problem.

CHAPTER IV.

Agricultural Education.

23. The conditions mentioned in last year's report, whereby we have been deprived of the greater part of our College buildings, have continued throughout the year, and this fact, combined with the occurrence of a severe and prolonged epidemic of plague in Poona, which spread to the locality where the bungalows

are situated which we had hired for the accommodation of the students, interfered considerably with the work of the Agricultural College and threw a severe strain on the staff. In view of this it is very satisfactory to note that the number of students now at the College, who are taking the full course, is larger than it has ever been before, and I think that we may now anticipate a steady increase. When our buildings are no longer required for a hospital and we are in a position to re-start the short course, the total number of students will show a marked increase.

24. An increasing number of old students take to farming on their own account, and the demand for our graduates is in excess of the supply. Some people appear to consider that the test of success of an Agricultural College is to be looked for in the number of its students who start farming with success on their own account when they leave the College, and there is, no doubt, something in the argument. It must be recognized, however, that there are various causes which operate against students taking this course. Some of them have no capital and others have no suitable land, while many who might be in a position to obtain the capital and the land are diffident of starting unaided farming on a scale sufficient to support them in the style to which they are accustomed. This last reason is perhaps the most operative, and the feeling on the part of the students is natural and justified in cases where the family circumstances of the students do not bridge over the gap which exists between the farming to which they have been accustomed under College conditions and the farming of which they are thinking as independent farmers. When students think of setting up for themselves as farmers they nearly always aim at growing sugarcane and other garden crops on a canal, and this is natural, since the chances of profit are higher, the risks less and the rewards for skill more assured under such conditions than in the case of dry farming. I found the same attitude prevalent amongst the students of Agricultural Colleges in the dry tracts of the United States of America where very successful colonies of students had been planted out on the canal areas. With the programme of canal development that we have before us in the Deccan I believe that there would be a great opening for our students on new canals where land can be obtained at easy rates, and to facilitate this we must try to bridge over the gap between college farming under supervision and business farming without assistance. I believe that this could be done if we had under a canal a compact area of (say) 200 acres equipped and ready for use, which we could temporarily lease out to suitable students in small areas suitable to their requirements. In such a colony would-be farmers could gain practical experience without undue risk, afford each other mutual assistance and obtain help from the Department when they require it. After a few years of farming under these conditions they would be in a position to make way for new-comers and to pass on to independent farming on a larger scale. I hope before long to be able to make proposals to secure this object.

Vernacular Agricultural Schools.

25. The following list shows the number of boys at each of our Vernacular Agricultural Schools :—

(1) Loni (Deccan)	45	Maráthi.
(2) Jámbul (Konkan)	13	Maráthi.
(3) Devihosur (Southern Marátha Country)	32	Kánarese.
(4) Mirpurkhás (Sind)	10	Sindhi.

The Jámbul School has been started only in June last. A Gujaráti school is to be started next year. The subject of Vernacular Agricultural Education has been fully dealt with in past years, and has recently been extensively discussed at various conferences, and I do not propose to offer any further remarks on the subject. Our schools are doing well, and I anticipate a demand for the gradual extension of the system.

CHAPTER V.

Agricultural Engineering.

26. The conditions of the past year have been unfavourable to the development of agricultural engineering, since machinery of all kinds was scarce and costly, coal was dear and difficult to obtain, and the season in the south of the Presidency was a remarkably wet one, which curtailed the season, always short,

available for steam ploughing. In spite of all difficulties the Agricultural Engineer has had a successful season and made progress; and in this he has been aided by the fact that he had got his workshop equipped just in time, and has thus rendered himself largely independent in the matter of repairs and adaptations. This workshop is a great asset to the Department.

27. Neither of the steam ploughs was able to pay interest and depreciation on capital value in addition to working expenses. The high prices of fuel and stores were against them, and so was the season in the south and the breakdown in Gujarát. It is of course all to the good that 1,600 acres a year should be broken up and cleaned; but until the ploughs can be shown to work at a profit as a business proposition it is unlikely that the public will take them up as such; and this is the object of the experiment. It is possible that the East Deccan, where the season is longer than in the Southern Marátha Country, would offer a better field for operations. It is also possible that the charges would bear putting up a little. The matter will receive attention.

28. The demand for power-plants still continues even at the present enhanced prices, and many purchasers continue to make good use of them. It needs, however, a keen and business-like man to make profitable use of a power-plant, and some men who have bought them as a fancy article, under the impression that they would run themselves, have found them a disappointment. Such cases, however, have not been many. Considerable difficulty has been experienced in finding a satisfactory way of distributing to the fields water that may be raised by a large power-driven pump. Stoneware pipes are very unsatisfactory in black soil, iron pipes very costly and earthen channels very leaky. I cannot say how the difficulty can be best surmounted; but experiments are being made.

29. The boring operations again show a large proportion of successes and confirm the opinions previously arrived at regarding the chances of finding water in the different parts of the Presidency. Full details are given in Appendix J. I still hope that next season will show better success in the Konkan where so far we have been unsuccessful.

CHAPTER VI.

Propaganda.

30. The following publications have been issued since those mentioned in last year's report, viz.:—

Bulletins.

(1) No. 82.—Cultivation of Drilled Paddy in South Bombay Presidency.
(2) No. 83.—The Spice Gardens of Sirsi in Kánára.
(3) No. 84.—Seed Selection Series—Kumpta Cotton.
(4) No. 85.—Note on Cattle in the Bombay Presidency.
(5) No. 86.—Establishment and Management of the Dairy Farm.

Leaflets (with vernacular versions).

(1) No. 7 of 1916.—Mánjri Farm Single-bullock Yoke.
(2) No. 8 of 1916.—The Mánjri Farm Tooth Cultivator.
(3) No. 9 of 1916.—Common defects in Bullock Shoeing.
(4) No. 10 of 1916.—The Katra or Hairy Caterpillar of Gujarát.
(5) No. 11 of 1916.—Páchat (Trash) as Manure for the Sugarcane Crop (Maráthi).
(6) No. 1 of 1917.—The Potato Worm and its control.
(7) No. 2 of 1917.—Rats on Cocoanut Palms and measures against them.
(8) No. 3 of 1917.—Separating heavy Cotton-seed for sowing.

31. The greater part of our propaganda is now of an informal nature, and our district staff address themselves in the first instance mainly to single individuals or small groups of individuals for the purpose of introducing some new crop, implement or method of cultivation into a tract. Some 150 formal shows and village demonstrations were, however, held during the year and in some cases met with considerable success in interesting the people. In the Southern Division ploughing competitions and standing crop competitions are now a popular feature of village shows. A class for mango grafting at Sátára was appreciated by the educated classes, and a similar class has been asked for at Dhárwár.

32. Four new Agricultural Associations came into existence during the year and one became defunct. The number of Agricultural Associations now stands at 63. Many of these Associations do useful work, but in the absence of funds such work is necessarily of a spasmodic nature and it is carried on by individuals rather than by the Association in its corporate character. In Khándesh, however, the Táluka Agricultural Associations have collected considerable funds and employ permanent agricultural assistants. In some cases the funds collected have been large, notably in the case of the Jalgaon and Bhusával Associations which each have to their credit over Rs. 8,000. Work of considerable value has been done in Khándesh through this agency. The Broach District Association undertakes a good deal of propaganda work, the Bijápur Association sold Rs. 9,000 worth of improved implements and the Kurtkoti Association organized a successful show and competition. The Deccan Agricultural Association continues to arrange for lectures on agricultural subjects and to hold cultivators' meetings. The Broach Agricultural Association, Deccan Agricultural Association and Dhárwár Agricultural Association issue their vernacular agricultural journals in Gujaráti, Maráthi and Kánarese, and these are widely read.

CHAPTER VII.

Miscellaneous.

33. *Horticulture.*—Considerable study on mangoes, oranges, guavas and figs has been in progress for some years past and good results are being obtained in several directions. The proper pruning of guavas and oranges in particular has shown marked advantage.

34. *Mycology.*—The campaign against smut on jowár, mildew on grapes and the *koleroga* disease of betel-nut has continued and been extended. Red rot on *pundia* sugarcane is found extensively in some localities in spite of disease-free seed being supplied and other precautions taken. For such tracts (e.g., Khándesh) the only thing is to use a variety of cane less susceptible to the disease. The *nectria* disease of citrus trees has been cured by the application of Bordeaux mixture.

35. *Entomology.*—In this line the most promising developments are the breeding of two parasites of the jowári stem-borer (*Chilo simplex*), which does such extensive damage to jowári and sugarcane. If the pest can be controlled in this way it will be of great value. An extract of the *tulsi* plant has been found very effective in attracting the mango fruit fly, and granary pests have been successfully controlled by fumigation with hydrocyanic acid. It is, however, very difficult to get cultivators to combine for a campaign against insect pests.

36. I have touched on only a few of the important lines of work and for further information would refer to the appendices to this report. The work of our graduate staff has varied greatly. Some have done very well; and I would this year select for special mention Mr. Gulabbhai N. Desai who is a most competent Farm Superintendent, and Mr. Athalye who has been active and successful in introducing agricultural improvements in the Násik District.

I have the honour to be,

Sir,

Your most obedient servant,

G. F. KEATINGE,

Director of Agriculture.

APPENDIX A.

REPORT OF THE POONA AGRICULTURAL COLLEGE FOR THE YEAR 1916-17.

College Buildings.

1. The year under report is the ninth since the establishment of the college as a separate institution. Almost at the end of the previous year, however, the main college buildings and the hostel, the bungalow of the Professor of Agriculture, the hospital assistant's quarters and other buildings, as well as some of the land round the college, was taken for the purposes of a war hospital. There was, in fact, left for college purposes only the chemistry block, the farm buildings, the bungalow of the Professor of Botany, and most of the farm. Hence work during 1916-17 has been carried on at very great discomfort and disadvantage. During the year the military authorities demanded also and obtained the space occupied by the playing field, the space at the back of the main college building and at the east of the hostel for the erection of temporary huts for hospital purposes. The students have been accommodated in part in the old quarters belonging to the college at Kirkee and partly in hired bungalows at Kirkee and Bhámburda. The Professor of Agriculture has been granted a bungalow at Kirkee, and quarters have also been found for the others dispossessed by the present arrangement, and a grant of Rs. 4,700 for 1916-17 was made for this purpose. It cannot be said that the present arrangements are convenient, but they enable the college to be carried on.

Agricultural Courses.

2. The University agricultural course, to which the main energy of the college is devoted, was modified in 1915-16, and the first stage in the introduction of the modified course has been made in the last year. So far as one can judge at present, the new course is likely to work well, and to give us graduates who are even better equipped for the business of life than has been the case in the past.

3. The short course which was started eight years ago, as an addition to the college work, and which is intended for farmers' and land-holders' sons, had to be suspended during 1916-17, owing to the loss of space and facilities due to the giving up of buildings for the military hospital. There is a real demand for this, and it was rapidly growing in popularity. It is extremely desirable to start this again at the earliest possible opportunity.

College Staff.

4. The staff of the college has varied very little during the year. Dr. Burns, Professor of Botany, was away during a large part of April, May and June, first at a musketry course at Sátára and then at an officers' course at Kirkee, but he did not take leave. Mr. H. M. Chibber, M.A., Assistant Professor of Botany, returned from England during the year, but only held the position for a very few months after his return, when he was (on *May 26th, 1917*) placed on duty as Acting Second Economic Botanist to Government. Mr. G. B. Patwardhan, B.Sc., who has on several occasions previously acted as Assistant Professor of Botany, has been again placed in that position.

The staff of the college farm altered considerably during the year. The superintendent, Mr. K. V. Joshi, B.Ag., after doing excellent work during the time he held the position, has now returned to the Konkan to take up special work with rice. His place has been taken by Mr. K. M. Pawar, B.Ag., who was formerly head master of the Loni agricultural school. His head assistant, Mr. K. S. Kulkarni, B.Ag., has now taken Mr. Pawar's place at Loni. His career is one of considerable promise. Mr. H. M. Desai, B.Ag., is newly appointed as third demonstrator in agriculture at the college.

Students.

5. The number of students in the new year (1917-18) is as high as in any previous year, in spite of the fact that there is no short course. The number of new entries is very large, and in addition the number of special and post-graduate students is larger than ever before. Of the seven such students, two are taking post-graduate training in dairying and animal husbandry and one in chemistry, while two are doing special work in chemistry and two in botany. The actual figures for the last seven years have been as follows :—

	1911.	1912.	1913.	1914.	1915.	1916.	1917, July.
First-year students ..	38	38	43	36	35	54	58
Second-year students ..	24	27	25	31	29	23	36
Third-year students ..	28	22	26	27	31	35	23
Short course students ..	13	15	15	22	27	Not held.	Not held.
Special and post-graduate students.	1	2	1	1	2	3	7
Total ..	104	104	110	117	124	115	124

These figures show the progress of the college. If we could have carried on the short course this year, it is almost certain that the numbers would have exceeded one hundred and fifty.

The students during the last five years included in the above table have come from the following parts of India :—

		1913.	1914.	1915.	1916.	1917.
Bombay Presidency	Deccan ..	28	23	20	14	9
	Southern Marátha Country and Konkan.	29	38	45	44	50
	Gujarát ..	27	23	35	29	36
	Sind ..	4	8	7	9	9
Assam		..	..	1	1	1
Central Provinces		1	..	..	..	..
Central India		3	3	3	3	1
Nizam's Dominions		5	7	3	4	6
South India and Ceylon		11	12	7	6	5
Burma		1	..	1	2	5
United Provinces		1	2	2	3	2
Berar		..	1	..	..	..

I am rather troubled about the decline in the number from the Deccan, but the increased popularity of the college in other parts of the Bombay Presidency is very obvious.

Arranged according to the castes or classes from which they come, the students stand as follows :—

	1913.	1914.	1915.	1916.	1917.
Bráhmins	45	43	55	49	55
Maráthas	5	5	5	4	4
Lingáyats	5	4	4	3	2
Pátidárs (Gujarát)	2	2	3	4	10
Mahomedans	10	7	12	10	8
Pársis	9	13	15	15	12
Europeans and Anglo-Indians	1	1	1	1	..
Others	33	32	29	29	33

6. These students may be divided into three classes :—

(*a*) By far the larger number are qualified to study for, and intend to take, the Agricultural degree of the Bombay University. The qualification on which the Bombay University insists, namely, the Previous Examination or its equivalent, is insisted on in the case of practically all students from the Bombay Presidency itself, and no student can, of course, appear for the University Agricultural degree without it.

(*b*) The second class consists of a few students who are not admissible to the University Examinations, but who are taking the regular course along with the first class of students. These exceptions arose from the fact that it has been decided by Government to allow scholars to be received from Sind who have only passed the Matriculation Examination, provided that they were to receive the same course, and pass by the same standard as the University demands. Under the ruling, students have been received every year since 1908. At the same time some applications were received from other Governments in India and Ceylon to be allowed to send students and from private persons outside the Presidency for admission to the college, where the applicants were not fully qualified for the University course. Where there was evidence to show such students could properly follow the course a small number have been admitted as follows :—

	Admitted in 1913.	Admitted in 1914.	Admitted in 1915.	Admitted in 1916.	Admitted in 1917.
Nizam's Dominions	..	1	..	1	2
Sind	1	2	1	1	..
Bombay Presidency and Native States subordinate to it.	..	2	2	5	..
Ceylon	..	..	..	1	1
United Provinces	1	1	..	2	..
Central India States	..	1	..	..	..
Coorg	..	..	..	1	..
Mangalore	..	..	..	1	..

(c) In the third place, we have the short course students already referred to. As has already been stated, the course has been closed in 1916-17 and 1917-18.

7. In addition to these classes we are being occasionally requested to undertake the training of men for special purposes. We admitted in 1916 a young man training for botanical work under the Department of Agriculture, Burma. We also had a man taking a special course for ultimate work in Burma, apart from the special and post-graduate students noted in paragraph 5.

University and other Examinations.

8. At the University Agricultural Examinations held in 1917 the number of candidates shown in the following list were presented with results as indicated :—

	Sent up.	Passed.	Failed.	Percentage of passes.
First Examination in Agriculture ..	38	29	9	76·3
Second Examination in Agriculture ..		Abolished.		
Bachelor of Agriculture Examination ..	30	30	*Nil*	100·0

A special College Examination of the students (referred to above), not entitled to take the University Examination, was held in April 1917 with the following results :—

	Presented.	Passed.	Failed.
First Examination in Agriculture	7	5	2
Second Examination in Agriculture	1	1	*Nil*
Final Examination for Diploma in Agriculture ..	5	5	*Nil*

9. The number of students who passed through the regular course at the College and succeeded in obtaining the University Degree or the College Diploma (which is of the same standard and represents the same character of man) is as follows during the past nine years :—

Year.	Degree.		College Diploma.		Total.	
	Entered.	Passed.	Entered.	Passed.	Entered.	Passed.
1909	34	26	..	..	34	26
1910	39	36	..	..	39	36
1911	22	20	5	5	27	25
1912	27	22	1	1	28	23
1913	19	14	4	3	23	17
1914	23	18	3	3	26	21
1915	21	20	6	5	27	25
1916	29	23	2	2	31	25
1917	30	30	5	5	35	35

I think it may be taken that in future the number who appear in the Final Agricultural Examination will be over thirty each year, and the number of graduates about twenty-five to thirty.

Scholarships.

10. The number of scholarships offered by Government at this College is now fifteen per annum. Candidates must have passed the Previous Examination of the Bombay University or obtain the certificate from the Principal of an Arts College, which the Bombay University now accepts instead of that examination, and are selected by the Director of Agriculture in consultation with the Principal of the College. They are given by preference to the sons of cultivators and are awarded for the three years occupied by the course. The Director of Agriculture is empowered to extend the tenure of the scholarships to four years and give a limited number to Matriculates, who afterwards will join this College, for study in an Arts

College. During the last six years scholarships have been awarded to candidates from the various districts as follows:—

	1912.	1913.	1914.	1915.	1916.	1917.
Deccan	6	2	2	..	3	3
Southern Marátha Country ..	2	3	4	5	5	7
Gujarát	..	2	4	2	2	3
Konkan	..	1	5	6	3	2

11. The students from Sind are on a different basis. They are appointed by the Commissioner in Sind, and are not required to have passed the Previous Examination in every case. We have now at the College two such scholars from Sind in the first year, two in the second year and two in the third year.

12. Other Governments and the public bodies have utilized the College for the training of scholars. The number so admitted since 1912 has been as follows:—

DATE OF ENTRY.

	1912.	1913.	1914.	1915.	1916.	1917.
Baroda Government	2	..	..	1	..	1
Sángli State	..	1	..	..	..	..
Aundh State	..	..	..	1	..	..
Jámkhandi State	1	1	..	..	..	..
Lingáyat Education Fund ..	..	2	..	..	..	..
Ceylon Government	4	..	..	..	..	..
Bánsda State	1	..	..	..	..	..
Rájpipla State	..	2	..	..	..	1
Junágadh State	..	1	..	..	3	3
Dewás State	..	..	1	..	..	..
Indore State	..	..	1	..	1	..
Mysore	..	..	1	..	..	..
Burma	..	..	..	..	1	4

LIBRARY.

13. The growth of the College Library is very satisfactory. Ten years ago it did not exist. On the separation from the College of Science being completed, a number of books (chiefly old and out-of-date) on Agriculture, Botany, and Veterinary Science were handed over to us and formed a nucleus for the future. A special grant of Rs. 6,000 per annum was made in 1909 for library purposes, and was continued during the two following years. Since that time the annual grant has been Rs. 2,500. With the funds thus made available and a number of presentations of books, the library has rapidly increased. The number of books in it at the end of the last nine years has been as follows:—

1908-09	1,182
1909-10	2,780
1910-11	4,000
1911-12	5,040
1912-13	5,943
1913-14	6,840
1914-15	7,638
1915-16	8,390
1916-17	9,143

It is fairly consulted, not only by College students, but by gentlemen from all parts of the Presidency, and every effort is made to make it increasingly useful to the public. It is now known and valued in every part of the Bombay Presidency at least.

COLLEGE QUARTERS.

14. The transference of the College buildings to the Military Department for use as a hospital in May 1916 involved the transference of the hostel and its attached buildings. This made it necessary to accommodate the students elsewhere in the neighbourhood of the College. The old quarters belonging to the College near the Boat Club at Kirkee, which have been used for the last two years for emergencies, were again fully occupied. Beyond this, bungalows were taken to accommodate the remainder at a cost of Rs. 478 to adapt them for our use, and at an annual rental of Rs. 3,180. The arrangement is inconvenient, but can be made to answer until our own hostel is again available.

Employment of Graduates.

15. The demand for agricultural graduates is increasing, and there seems now little trouble in placing the good men. As I write I have several applications in hand for men, to fill which I have difficulty in finding satisfactory candidates. Of the past students of the regular three years' course who have been employed or arranged for during the year, the direction of activity is as follows :—

Bombay Agricultural Department	10
Bombay Co-operative Department	2
Bombay Revenue Department	1
Central Provinces Education Department (for Nature study)	4
Employed on their own land or in connection with industries depending on agriculture ..	6
Agricultural Departments of Native States ..	2
Engaged in further training in horticulture ..	1

College Dairy.

16. During the year the Government Civil Dairy at Kirkee has been under the control of the College and the Manager of the Dairy is Assistant Professor of Dairying. This has been used for several years as a teaching centre for dairying for the students and in future it will be available in greater measure than hitherto, as this is now recognized as one of its primary functions.

Veterinary Dispensary.

17. The District Veterinary Dispensary at Bhámburda has been carried on as a College Dispensary during the year. Charge of the dispensary was in the hands of Mr. F. Gracias, G.B.V.C., assisted by Mr. B. B. Joshi, G.B.V.C., as Resident Veterinary Officer. During the year there has been a considerable increase in the number of patients. A total of 1,915 animals were treated (as against 1,643 in the previous year), of which 391 were in-patients and 1,526 were out-patients. The daily average attendance of in-patients was 16·2 and of out-patients 19·9. Of those treated, 1,077 were agricultural animals. Out of 1,915 cases, 1,038 were treated free. Among contagious diseases there were fifteen cases of suspected rabies in dogs, of which five proved to be rabid. Thirty-one outbreaks of epidemic disease were attended in the Haveli Táluka and Mulshi Peta during the year under report. These consisted of foot and mouth disease, black quarter and rinderpest. The dispensary staff have been given charge of these areas of the Poona District for epidemic work. The police have continued to take advantage of the dispensary for carrying out post mortems in medico-legal cases.

Other Matters.

18. A course in arboriculture for subordinates of the Public Works Department was undertaken for the third time in January and February 1917 and was attended by ten men. The organization of the course was entirely in the hands of Dr. W. Burns and the instruction was actually given by Mr. H. P. Paranjpye, B.A., Assistant Economic Botanist. The success of the course was entirely due to the enthusiatic work of these officers.

APPENDIX B.

REPORT OF THE MARATHI AGRICULTURAL SCHOOL, LONI, POONA, FOR 1916-17.

1. The Maráthi agricultural school at Loni has now passed beyond the stage of experiment. It will be remembered that it was established in Poona in 1910 as an agricultural boarding school, the object of which was to give a thoroughly practical training to boys, who belonged to good substantial cultivating and land-owning families, whose object in life was to cultivate or manage their own lands. The course is one of two years for boys by preference between the ages of 14 and 17, who have at least passed the fourth Maráthi standard. It is under the supervision of the Principal of the Agricultural College, but is quite independent of the College, with an experienced agricultural graduate as head master.

2. The school was removed to Loni, to land and buildings specially prepared for it, in November 1913, and has been carried on there since that time. In laying out the school at Loni, an attempt was made to make the whole property as much like a substantial cultivator's holding as possible. The area is twenty-nine acres and is practically entirely worked by the boys. It contains land suitable for cultivation with and without irrigation, and a small fruit plantation has been laid out. A portion is irrigated by means of a small oil engine, which every boy has to learn to drive himself. The school and residential buildings are laid out like a large village *wáda*, and the whole place is really a self-contained agricultural centre. No new buildings have been put up during the past year, but the gymnasium (built by the contributions of the parents of past and present boys) has been fitted, and the small museum has been partly prepared for use.

3. The boys at present in the school number forty-five, derived from the Maráthi-speaking districts as follows :—

	1st year.	2nd year.
Poona ..	2	..
Sátára ..	2	1
Sholápur ..	3	..
Ahmednagar ..	2	3
Násik ..	7	1
East Khándesh ..	4	2
West Khándesh ..	1	..
Ratnágiri ..	..	1
Belgaum ..	1	..
Bijápur ..	1	..
Dhárwár ..	1	..
Kolhápur State ..	1	3
Ichalkaranji State ..	1	..
Jámkhandi State ..	2	..
Berár ..	3	2
Central Provinces ..	..	1
Total ..	31	14

4. Arranged according to caste the boys stand as follows :—

	1st year.	2nd year.
Maráthas ..	17	8
Gujarátis ..	1	..
Bráhmins ..	12	6
Jains ..	1	..

Those admitted are carefully selected from a much larger list, and only those who are genuine cultivators or land-owners who intend to work their land are as far as possible admitted.

5. There have been two changes of head master during the year. Mr. K. M. Pawar, B.Ag., who had been in charge of the school from its foundation, has been transferred to the Agricultural College as Superintendent of the College Farm and Demonstrator in Agriculture. I cannot speak too highly of his work during over six years in which he was responsible for the school, and whatever success it has achieved and whatever confidence it has gained is largely due to Mr. Pawar's work. His place was temporarily taken by Mr. V. B. Parbhune, B.Ag., and on

his transfer to the school at Jambul (Thána), Mr. K. S. Kulkarni, B.Ag., who had proved himself an efficient teacher and worker at the College, was placed in charge of the school in May 1917. He has made an excellent beginning.

6. The school has been supported by a number of district local boards, and during the past six years the following subsidies have been received :—

	1911-12.	1912-13.	1913-14.	1914-15.	1915-16.	1916-17.
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
West Khándesh	..	..	..	..	54	..
East Khándesh	200	72	..	72	216	432
Poona	..	720	..	..	792	144
Násik	250	216	288	..	788	500
Ratnágiri	..	216	..	..	144	216
Sátára	116	432	504	288	72	72
Sholápur	50	420	504	288	72	..
Ahmednagar	100	..	840	72	144	288
Thána	..	72	144	72	..	72
Bijápur	..	72	..	..	..	..
Kolába	..	72	..	..	..	..
Belgaum	..	..	72	144	72	72

The trustees of the Sir Sassoon David Trust have made a grant of Rs. 500 to the school, being the whole cost of the training of three boys. Our thanks are due to the generous donors of these amounts.

7. The curriculum has remained as before, as, on the whole, it has been quite successful. It involves, as I explained in last year's report, at least half the working time being spent in farm work, or in gardening, in dairying, or in other agricultural operations. The boys do practically all the work on the land allotted to their use, and they have almost entirely produced the food and fodder, except the grain and pulse, used in the school. The school work more properly so called consists of arithmetic, more especially including farm accounts on the one hand, and mensuration applied to agricultural purposes on the other; nature study largely taught practically; writing and reading; geography of India, especially in relation to crops; the principles of agriculture; and two new subjects (1) 'Village Life' including sanitation, hygiene, and secondary occupations suitable for villages; and (2) what we call 'Citizenship,' which includes question of how to obtain money by *takávi*, by co-operative credit, or by other methods, and in addition, the system of local and village Government in this part of India. The management of fowls is being undertaken now for the first time.

8. The number of applications for admission to the school has been considerably greater than we can take, but a careful selection was made, and admission is, as a rule, only granted to those who are themselves cultivators, or who are small land-owners, where the boys are intended to devote their life to work in connection with land. The course is, moreover, a hard and practical one, and unless a boy is ready to work on the land at what some consider menial occupations he does not want to stop, and so there is often considerable leakage at first. It is, I feel, nevertheless, essential to maintain this tone if the school is to serve the purpose for which it is intended. The number of applications for admission this year has been greater than ever, and I could have had more suitable boys than the accommodation allows.

9. As usual the school has been visited both by leading officers of Government and others, as well as by many of the parents and friends of the boys. Among those who have been to Loni in the year under report are the Honourable Mr. H. Sharp, Educational Commissioner with the Government of India, Mr. C. A. Townsend, Director of Agriculture in the Punjab, Ráo Bahádur Govindbhai H. Desai, Revenue Minister of Baroda, and many others.

10. At the end of the school year in April 1917 the boys were examined by Messrs. K. S. Kulkarni of the Agricultural College and H. P. Paranjpye, Superintendent of the Ganeshkhind Gardens, and as a result twenty-nine certificates were granted to boys who had completed their two years' training. The examiners made remarks as follows :—

I.—"I find the 1st year students weak in Maráthi, especially in reading and writing. The text-books seem to be difficult for them. Many of the students could not express properly what they wanted to say. They often write or repeat a well-worded sentence from their text-books. I think it would be better if the students write down daily what they do either in the class or in the field.

"In Surveying the majority of the students did well indeed; only a few were found weak.

"In Mathematics students of both classes were up to the mark."—H. P. PARANJPYE.

II.—"I examined the boys as under :—

(*A*) *1st year students*—

I. Papers—(1) Principles of Agriculture, (2) Nature Study, (3) Geography, (4) Sanitation.

II. Practicals—(1) Practical Agriculture, (2) Practical smithy and carpentry.

"I find the boys lack power of expression in general. The whole batch is quite below the average in general with the exception of only two or three. In practical work they were better in item No. 2 and item (1) came next.

(*B*) *The 2nd year students*—

I. Papers—(1) Principles of agriculture, (2) Science.

II. Practicals—(1) Practical agriculture, (2) Practical smithy and carpentry.

"The boys were better in all subjects, their best in papers being agriculture and nature study next.

"In practicals agriculture stands first and workshop next.

"On the whole, the 1st year boys seemed to have in general a poor grounding before they entered the school.

"The 2nd year students exhibited better knowledge. This may also be due to the fact that they have already passed a year in an agricultural atmosphere."—K. S. KULKARNI.

11. One hundred boys have now completed their course and been granted certificates. Most of these are farming either on their own or on other land. We are keeping as far as possible in touch with them. Many of them are becoming centres of influence for the future. A *réunion* of old students was held in April 1917, and this was attended by Mr. P. C. Patil, Deputy Director of Agriculture, Mr. Pawar the old head master, Mr. Hulkoti, head master of the Kánarese agricultural school in the Dhárwár District, and many local gentlemen,—and was addressed by Professor H. G. Limaye of the Fergusson College. A very large number of the old boys came and recounted their experiences.

12. The accounts of the school are shown in the following statement :—

Receipts.	Rs.	a.	p.	Expenses.	Rs.	a.	p.
1. Poona Treasury (Government grant).	8,812	8	2	1. Establishment ..	1,867	13	6
2. Local Board grants ..	1,796	0	0	2. Boarding charges ..	2,999	8	11
3. Grant from Sir Sassoon David Trust Fund.	750	0	0	3. Purchase of live-stock ..	391	0	0
4. Sale-proceeds, etc. ..	477	2	6	4. Cultivation charges, Purchase of carts, etc.	960	0	0
5. Hire of Ploughs ..	254	8	6	5. Feeding of stock ..	600	0	0
6. Director of Agriculture ..	100	0	0	6. Draining, levelling and making garden.	200	0	0
				7. Conservancy charges ..	160	0	0
				8. School furniture and books.	40	0	0
				9. Postage charges ..	45	0	0
				10. Travelling allowance and tours.	597	15	9
				11. Running of workshop and oil engine.	520	0	0
				12. Irrigation charges ..	41	2	0
				13. Remitted to the Treasury.	2,527	11	0
				14. Miscellaneous Office expenses.	340	0	0
				15. Petty construction charges.	900	0	0
Total ..	12,190	3	2	Total ..	12,190	3	2

HAROLD H. MANN,
Principal, Poona Agricultural College.

APPENDIX C.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, NORTHERN DIVISION, IN 1916-17.

1. The charge of the two divisions, Northern Division and Central Division, was held by me throughout the year except one month in September-October when I was on leave.

Mr. Bhimbhai M. Desai continued as Divisional Superintendent of Agriculture, Northern Division. He was on sick leave for six months on medical certificate, when Mr. Gulabbhai N. Desai acted for him. Mr. V. K. Kogekar continued as Acting Divisional Superintendent of Agriculture, Central Division, throughout the year. The third division, *viz.*, the Canal charge, was held by Mr. G. N. Sahasrabudhe as Sugarcane Expert throughout the year.

2. District work, both demonstrational and advisory, is initiated by now in all the districts. The following shows the distribution of the staff in the districts:—

Charge.	Divisional Inspector.	Graduates.	Non-graduates.	Kamgars.		Remarks.
				Appointed by the Department.	Appointed by the Agricultural Associations.	
Northern Division.	1					
Ahmedabad ..	..	1	..	2	..	
Kaira ..	..	1	1	3	..	
Panch Mahâls ..	..	1	1	2	..	
Broach ..	..	1	..	..	..	
Surat ..	..	1	1	1	..	
Central Division.	1					
West Khándesh ..	..	1	2	1	2	
East Khándesh ..	..	1	2	3	4	
Násik ..	..	1	..	3	..	
Ahmednagar ..	..	1	1	2	..	
Poona ..	..	1	1	1	..	
Canals ..	1 (Sugarcane Expert)	..	2	8	..	
	3	10	11	26	6	
	..	4	1	..	..	Four graduates and one non-graduate are entertained after April 1917.
Total ..	3	14	12	26	6	

It may also be noted that six of the Kamgars are appointed by the Agricultural Associations, one in 1915-16 and five in 1916-17, at the request of the Agricultural Department and their work is looked after by the Department.

3. The following shows the number of agricultural stations and plots in my charge :—

No.	Name of the Agricultural Station.	Strength of the Station.	Area.		Object and Remarks.
			A.	G.	
1	Agricultural Station, Surat ..	1 Superintendent .. 2 Graduates. 3 Non-graduates. 1 Store-keeper.	273	32	General purpose farm and to study cottons in particular.
2	Agricultural Station, Nadiád (District Kaira).	1 Overseer ..	44	0	Fodder growing and fodder preserving investigations.
3	Agricultural Station, Broach ..	Looked after by District Agricultural Overseer.	27	0	Study of cottons (Ghogari) and of local rotations.
4	Agricultural Station, Dohad (District Panch Mahâls).	1 Superintendent .. 1 Graduate. 1 Non-graduate. 1 Store-keeper.	58	9	General purpose farm. Maize, wheat, cotton, groundnut and paddy are grown.
5	Agricultural Station, Dhulia (West Khándesh).	Looked after by District Agricultural Overseer. 1 Non-graduate.	28	20	Cotton, wheat and fruit culture.
6	Agricultural Station, Jalgaon (East Khándesh).	1 Superintendent .. 1 Non-graduate.	204	31	Cotton (N. R.)

No.	Name of the Agricultural Station.	Strength of the Station.	Area.	Object and Remarks.
			A. G.	
7	Fodder Farm, Kopergaon ..	1 Overseer (Non-graduate). .. 1 Fieldman.	109 19	Fodder investigations.
8	Sugarcane Farm, Kopergaon ..	1 Superintendent ..	5 0	Sugarcane investigation on canal.
9	Nagar Farm ..	Looked after by District Agricultural Overseer. 1 Fieldman.	15 0	Dry Farming; tillage with reference to soil, moisture and conservancy.
10	Amalsad Plot (District Surat) ..	1 Non-graduate ..	4 14	Sugarcane investigation and garden cultivation in general. The area is increased to 19 acres 12 gunthas from 1st April 1917.
11	Sunevkela Plot (District Broach)	Looked after by the District Agricultural Overseer, Broach.	4 0	Manurial experiments for reclaiming salt lands.
12	Shevgaon Plot (District Ahmednagar).	Looked after by Non-graduate Overseer in charge of district work of Nevása and Shevgaon Talukas.	3 0	Introduction of N. R. cotton and groundnuts in the tract.

Number of graduates ..	7
Number of non-graduates ..	11
Number of Store-keepers ..	2

4. Besides there are about 104 temporary demonstrational plots, 32 registered seed growers' plots, 30 implement depôts, which are looked after by the District staff with the help of Kamgars, honorary workers and the owners of seed plots.

5. The following shows the list of Agricultural Associations. Some are old but most are newly formed. The work of the old as well as of the new Associations is being organized and their finances watched to some extent.

Serial No.	Name of Agricultural Association.	Headquarters.	Membership.	Funds.	Annual income.	Remarks.
	Northern Division.			Rs. a. p.	Rs. a. p.	
1	Agricultural Association, Bulsár-Párdi.	Bulsár ..	25	150 0 0	25 0 0	The information refers to 1916-17.
2	District Agricultural Association, Broach.	Broach ..	126	5,523 1 3	462 0 0	
3	District Agricultural Association, Nadiád (District Kaira).	Nadiád ..	10	6,286 14 4	687 14 0	
4	Taluka Agricultural Association, Nadiád.	Nadiád ..	20	20 0 0	20 0 0	
5	Agricultural Association, A'nand .	A'nand ..	295	295 0 0	266 0 0	
6	Agricultural Association, Borsad	Borsad ..	144	42 0 0	144 0 0	
7	Agricultural Association, Mehemdabad.	Mehemdabad ..	31	145 0 0	15 0 0	
8	Agricultural Association, Prántij	Prántij ..	64	181 4 6	206 3 0	
9	Agricultural Association, Viramgám.	Viramgám ..	24	382 0 0	82 0 0	
10	Panch Maháls Agricultural Association.	Resumed activities recently.				
	Central Division.					
11	District Agricultural Association, East Khándesh.	Jalgaon ..	..	5,000 0 9	150 0 0	Funds were subscribed by all farmers.
12	Taluka Agricultural Association, Jalgaon.	Jalgaon ..	..	8,483 10 4	1,032 0 0	
13	Taluka Agricultural Association, Páchora.	Páchora ..	1,000	1,000 0 0	1,018 0 0	The information refers to 1915-16.
14	Taluka Agricultural Association, Chopda.	Chopda ..	750	1,122 2 3	581 9 5	
15	Taluka Agricultural Association, Bhusáwal.	Bhusáwal ..	1,162	8,835 0 0	1,981 0 0	
16	Taluka Agricultural Association, Amalner.	Amalner ..	15	1,256 8 2	....	
17	Taluka Agricultural Association, Jámner.	Jámner	181	1,303 0 0	912 0 0	
18	District Agricultural Association, West Khándesh.	Dhulia ..	45	317 15 4	76 0 0	
19	Taluka Agricultural Association	Shirpur ..	169	533 8 2	165 11 11	
20	Taluka Agricultural Association, Nandurbár.	Nandurbár ..	33	270 8 6	8 2 0	
21	Taluka Agricultural Association, Yeola.	Yeola ..	40	853 13 8	....	
22	Taluka Agricultural Association, Málegaon.	Málegaon ..	42	57 11 0	....	
23	Taluka Agricultural Association, Shrigonda.	Shrigonda		248 5 11	....	
24	Taluka Agricultural Association, Sangamner.	Sangamner ..	72	250 0 0	40 0 0	
25	Taluka Agricultural Association, Shevgaon.	Shevgaon ..	65	69 15 3	109 0 0	
26	Taluka Agricultural Association, Jámkhed.	Jámkhed ..	21	115 6 7	5 6 0	
27	Taluka Agricultural Association, Nevása.	Nevása ..	46	307 6 3	63 12 8	
28	Deccan Agricultural Association	Poona	..	8,483 10 4	1,032 0 0	

Note.—Information from some of the Agricultural Associations could not be got in time and hence these could not be included.

6. Besides with the help of the officers of the Revenue and Co-operative Departments seven seed societies, one manure society (at Niphád), two sale societies or cotton markets (at Chálisgaon and Páchora) are formed during the year under report. Such societies and markets are very essential to safeguard the interests of the farmers.

7. The following tables show the progress in the number of Agricultural Associations, implement depôts, registered seed growers, as also in the receipts on account of sale and hire of implements and manure and seed distribution. etc. :—

		1914-15.	1915-16.	1916-17.
Number of Agricultural Associations.	Central Division	21	25	28
	Canal charge	..	..	2
	Northern Division	5	5	10
		26	30	40
Number of Implement Depôts	Central Division	9	8	20
	Canal charge	..	14	7
	Northern Division.	..	1	7
		9	23	34
Number of Seed Growers' Plots ..	Central Division	11	20	32

Sale of Implements.

	1914-15.	1915-16.	1916-17.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Central Division ..	6,513 5 0	6,728 0 6	10,845 4 3
Canal charge ..	....	480 0 0	1,547 0 0
Northern Division ..	....	774 15 3	2,360 14 3
Sale on Government Farms ..	3,693 11 11	3,109 15 7	4,878 14 5
Total ..	10,207 0 11	11,092 15 4	19,632 0 11

Hire of Implements.

	1914-15.	1915-16.	1916-17.	
	Rs. a. p.	Rs. a. p.	Rs. a. p.	
Central Division ..	359 3 0	1,132 15 4	1,708 13 0	
Canal charge ..	....	726 15 6	1,233 3 0	
Northern Division ..	....	....	*	* Hire charges recovered in Northern Division will be shown in 1917-18 as the Depôts were opened in April 1917.
Total ..	359 3 0	1,859 14 0	2,942 0 0	

Manure Distribution.

	1914-15.	1915-16.	1916-17.
	Rs. a. p.	Rs. a. p.	Rs. a. p.
Central Division ..	294 0 0	1,726 7 0	1,725 13 0
Canal charge ..	....	6,770 0 0	10,551 0 0
Northern Division ..	....	....	....
Total ..	294 0 0	8,496 7 0	12,276 13 0

Cotton Seed Distribution.

	1914-15.	1915-16.	1916-17.
	lbs.	lbs.	lbs.
Northern Division ..	16,378	33,956	38,593
Central Division	37,745	110,090	134,083
Outside Central Division. } N. R. cotton	....	..	156,473
Total ..	54,123	144,046	329,149

Distribution of other Seeds.

	1914-15.		1915-16.		1916-17.	
	lbs.	Rs. a. p.	lbs.	Rs. a. p.	lbs.	Rs. a. p.
Northern Division ..	50	....	3,037	....	6,438	....
Central Division ..	....	1,019 9 0	..	2,071 7 4	29,575	....
Canal Charge ..	....	....	..	201 0 0	3,647	....
	50+	1,019 9 0	3,037+	2,272 7 4	39,660	

8. During the last few years efforts are being made to encourage indigo in Khándesh and Broach Districts, groundnut in Prántij and Dohad Talukas, and sugarcane on Godawari, Kadwa and Girna Canals. The following statement shows the steady increase in the acreages. Water being the principal factor in sugarcane growing, Irrigation Department claim more credit for this increase. The Agricultural Department supplemented the efforts of the Irrigation Officers by encouragement and expert advice.

		Acres.		
		1914-15.	1915-16.	1916-17.
Indigo ..	Khándesh District ..	8	84	214
	Broach District ..	..	..	35
Groundnut ..	Ahmedabad District ..	207	834	1,456
	Panch Mahals ..	1,158	1,887	2,032
Sugarcane ..	Jamda ..	47	48	100
	Girna ..	3	31	97
	Kadwa ..	300	283	347
	Pravara ..	641	1,036	1,330
	Godavari ..	2,436	2,791	4,187

9. It will therefore be seen that the administrative and district work in this division has increased very much. The growth is natural and healthy, and to keep pace with the growth it is essential to divide the charge into two divisions in the first instance as soon as possible.

10. Most of the work in Central Division was continuation and further development of the old. In Gujarát, however, some of the activities were new and life had to be put in the old and I had to spend most of my available time and energy there. The district work in the canal area is extending. The details of the work on the farms are published separately and needs only a passing mention.

11. No very important alterations were made in the programme of last year at Nadiád, Dohad, Broach, Jalgaon, Ahmednagar and Kopergaon (Fodder Farm). Chicory was for the first time tried at Nadiád and Dohad with the co-operation of Dr. Mann. It seems it will be an useful introduction in Goradu soils of Gujarát. At Surat, number of experiments had supplied sufficient cumulative data and their interpretations have appeared in the reports. The experimental and non-experimental areas are therefore put now in separate blocks and the responsibility of their management is thrown on the assistants as well.

12. A new plot was opened at Kopergaon (Ahmednagar) during the year under report to investigate the problems underlying sugarcane industry on the Godavari and Pravara Canals. Labour in this tract is very costly and to show economy in labour a power crusher is installed. The work is appreciated by the cane planters.

Crops.

Cotton.

(Khándesh, Nagar and Násik Districts.)

13. The general organization of the supply of N. R. cotton has been described in previous reports. So far Jalgaon Farm seed is supplied to the registered seed growers on certain conditions and the seed, purchased back from them, is distributed to the general public. Though the area under registered seed plots is increased considerably, it is found difficult to meet the growing demand. Moreover it is very expensive to expand the old scheme departmentally. It is therefore attempted to form co-operative seed societies to grow and distribute N. R. cotton-seed. The Department will supply pure seed to the central farms (or in the first instance to one or two of the best seed growers) of the societies. The seed produced on such farms will go to the seed growers of the respective

societies and their seed in return will go to the general public. Seven such societies have been formed during the year under report with the co-operation of the Co-operative Department and their work is watched. If this scheme proves successful—and it is expected it will—distribution of N. R. cotton can be extended vastly with comparatively less strain on the Department. During the year under report about 290,556 lbs. of N. R. cotton seed was distributed.

Further work on improving N. R. cotton is continued at Dhulia and Jalgaon. Promising crosses between Comilla and Bani referred to in previous reports are sown for comparison.

Gujarát.

14. The scheme adopted last year and the year before is followed during the year under report. The sub-joined statement gives the names of villages and the strain distributed, etc.

Names of villages.	Strain.	Area sown with the strain.	
		A.	G.
1. Althan ..	Selection II ..	162	8
2. Bhatar ..	Selection I ..	144	35
3. Umra ..	1027 ALF ..	97	10
4. Piplod ..	Selection I-A ..	88	14
5. Bharthana ..	Selection II ..	287	1
6. Athwa and Majura ..	1018 P/G ..	116	11

The lint was sold in three instalments.

No.	Date of contract.	Quantity of seed cotton contracted.	Lint obtained.	Seed obtained.	Amount realized for lint sold.	Rate per bhar (924 lbs.) of Farm cotton.	Rate per bhar of local cotton on that day.	Quantity of seed cotton required to make up one candy (784 lbs.) of lint as ascertained from gin.	
								Farm cotton.	Local cotton.
		lbs.	lbs.	lbs.	Rs. a. p.	Rs. a. p.	Rs. a. p.	lbs.	lbs.
1	11th March 1917 ..	266,438	84,238	177,047	51,017 13 2	176 12 0	165 0 0	1,546·8	1,608
2	4th April 1917 ..								
3	21st May 1917 ..	54,005	16,547	35,934	9,419 8 9	160 0 0	149 0 0	1,550·4	1,620

They realized on account of superior strains about Rs. 11 more per bhar (of 924 lbs.). Really speaking the market has not sufficiently paid for the quality when allowance is made for the higher ginning of the strains. The Honourable Mr. Pursotamdas Thakordas of Messrs. Narandas Rajaram and Company was satisfied with the strains and had sent some bales to Liverpool for valuation. The following is the extract of his letter to the Divisional Inspector of Agriculture, Northern Division :—

> "Samples of your bales 10 SRT are just up and we have got a spinner on to them and hope to get 19¼*d.* for them, landed terms. The colour of the staple are nice and I only wish we had more of this cotton here at present."

Breeding work on Surat and Broach Farms is continued on the lines described in previous years. Individual selection, however, will be continued longer before mass selection is resorted to.

Ahmedabad District.

15. Ahmedabad grows about 337,825 acres of cotton and it was thought necessary to enquire into the cottons of this district. The Cotton Supervisor, Northern Division, was deputed on this work for eight months. I also took two trips, in one of which the Imperial Cotton Specialist accompanied us to Viramgám and Bavla. In this district several varieties of cottons are grown often in the same tract and consequently there is mixture in every variety. The study of cottons in Ahmedabad District is very interesting though very difficult and complex. Probably the environments are responsible in giving some recognisable characters to the types

like the Wagad, the Lalio, and hence the question of substituting any herbaceum variety by another seems to be of doubtful success. The Cotton Fieldman, Surat, has, however, been asked to study the cottons to find some distinct types in Lalio and Wagad varieties, which will be gone into carefully with the advice of the Imperial Cotton Specialist.

Sugarcane.

16. Work on sugarcane can be divided into four sections—

(*a*) Work on the canals (Girna, Kadwa, Godavari and Pravara).

(*b*) Work on Bandharas in the Nasik District.

(*c*) Work at Amalsad (Surat District).

(*d*) Work at Kasandra (Ahmedabad District).

(*a*) Advisory and demonstrational work was continued on the lines already described in the last year's summary of work. The implement and manure depôts have become popular. Advice of the Department is freely sought by the cane-growers. Such a work, being taken up in time, has prevented possible set-backs and has done lot of good. Necessary co-operation of the Irrigation Officers and confidence of the irrigators have enabled us all to record the following increase in the area under sugarcane on the canals :—

	1914-15.	1915-16.	1916-17.
Jamda Canal ..	47	48	100
Girna Canal ..	3	~~30~~ 31	97
Kadwa Canal ..	300	283	347
Pravara Canals ..	641	1,036	1,330
Godavari Canals ..	2,436	2,791	4,187

Wide planting method is gaining ground. Two irrigators have purchased power plants for crushing sugarcane. The work on the sugarcane plot suffered for several reasons ; yet it showed that on *khalgat* soils Khadya cane (planted 3 feet apart) would do better.

(*b*) The work on Bandharas is very fruitful and the cultivation is improving fast. People have been using iron mills and Poona furnaces and now three power plants are working. People are using tons and tons of concentrated manures where none was used before about seven years. Experience goes to prove that even Khadya cane responds to concentrated manures quite freely.

(*c*) Work at Amalsad is being further developed. Demonstration of clean crushing and economical methods of making *gul* are being given.

(*d*) Demonstrational work at Kasandra was much appreciated on the estate, but since there is only a limited area under cane further work is discontinued.

Wheat and Jowar.

17. Work on wheat is continued at Dhulia and Dohad and on jowar at Surat. The latter is more promising.

The Farm pedigree seed has given uniformly better outturns than the same varieties purchased locally in the market as will be seen from the following statement. The Farm and local jowars were sown in alternate rows.

Kind of seed of Jowar.	Yield per acre in lbs.		Value of produce per acre in Rs.	Cost of production per acre in Rs.
	Grain.	Bye-product.		
			Rs. a. p.	Rs. a. p.
Farm Perio ..	718	1,440 218	46 11 2½	11 6 3
Local Perio ..	688	1,376 192	43 9 11½	11 6 3
Farm Chapti ..	922	1,840 148	59 15 6½	11 6 3
Local Chapti ..	743	1,440 138	47 14 9½	11 6 3
Farm Sholapuri ..	834	1,280 200	48 4 2	11 6 3
Local Sholapuri ..	808	1,236 156	46 7 9½	11 6 3

New Crops.

Chicory.

18. Due to war there is keen demand for chicory for mixing with coffee and at the instance of Dr. Mann this crop was tried at Dohad and Nadiád. It has given promising indications at Nadiád and the crop is now put on larger scale.

Crop Pests, Etc.

19. (*a*) During the year under report *Katra* (hairy caterpillar) caused considerable damage to maize crop in the Panch Maháls. On the Government Farms at Dohad and Nadiád this pest has been combated against successfully by means of drag nets and its moths by light traps.

(*b*) Jowar stem borer was another important pest towards Surat. In the retentive soils of Gujarát it breeds freely in the jowar stubbles and the Entomological Assistant found caterpillars in 20 to 32 per cent. of standing stubbles. On this account it is found useful to harrow the fields and grub up the stubbles. The stubbles must be collected and burnt.

(*c*) In Khándesh cotton leaf-eating caterpillar (*Cosmophila Crosa*) was found to cause considerable damage to young cotton plants.

(*d*) *North-West Locust.*—Locusts of the first brood appeared in the North Gujarát, Cutch and Káthiáwár in the second week of June. Only a few laid eggs on the borders of Rádhanpur and Pálanpur States. The young hoppers had not much to eat and were destroyed by birds, etc. Small swarms of the second brood appeared in the month of October.

(*e*) *Termites.*—This is a serious pest of most crops in sandy *goradu* soils and attempts are made to deal with this pest. Several remedies were tried and finally digging of their nests was resorted to. On a Farm of about 200 acres, 170 nests were dug at a cost of Rs. 40. From these nests 54 queens of termites were removed.

(*f*) During the year under report copper sulphate packets were sold as noted below :—

Ahmedabad	..	528	Surat	..	758
Kaira	..	18	Panch Maháls	..	50
East Khándesh	..	10,950	Násik	..	175
West Khándesh	..	337	Ahmednagar	..	1,413
Broach	..	585	Poona	..	473

In addition, Union Agency, Bombay, sold a good number direct. Steeping jowar seed in copper sulphate solution is a best remedy against smut and people are taking to it steadily.

Implements and Machinery.

20. Improved implements and machinery are becoming very popular. In spite of the war conditions the sale of the implements has increased considerably. In this Division implements worth Rs. 19,632 were supplied by my staff besides those supplied by the Professor of Agriculture from his Farms and by private firms direct. Implement depôt scheme is very successful and we could return into treasury Rs. 2,942 as hire of implements.

During the year under report two very successful machines (a corn sheller and a groundnut husking machine) have been added to the list. Being hand-driven, these are not very costly. Their work is much liked by the farmers.

At Kopergaon a power plant for crushing sugarcane and also for shredding and baling *kirbi* is installed. This is the first year of its work. Detailed information will be given in next year's summary of work after getting sufficient data.

The Kankreji Breeding Herd at Surat.

21. The strength of the herd on the 1st April 1917 was 107 as against 94 on the same date in 1916. The total quantity of milk produced during the year was 79,349 lbs. as against 63,576 lbs. in 1916. This quantity of milk was yielded by 32 cows. The annual average yield per cow, therefore, comes to 2,407 lbs. against the average of 2,119·2 lbs. in the year 1916. Eight bull calves were sold during the year. On the whole the progress of the herd as a breeding herd is satisfactory. Financially, however, the herd is not yet self-supporting if the feed and fodder are charged at market rates, there being Rs. 448 loss. If, however, the feed and fodder were charged at cost price, then the balance sheet shows a profit of Rs. 1,105 for the year under report.

Milk Industry in Gujarát.—This question is being further studied and it is desired to put the information together if time permits.

Shows and Demonstrations.

22. During the year under report 25 organized demonstrations as noted in the margin were conducted in addition to a large amount of informal work carried throughout the year by the district staff. The District Agricultural Overseers always go round their charge and give advice on crops, manures and implements and do lots of things. Their work is varied and is spread throughout the year.

No.	Place.	Date.
	Khándesh District.	
1	Jalgaon Farm ..	9th October 1916.
2	Asoda ..	4th November 1916.
3	Edlabad ..	19th November 1916.
4	Ner ..	March 1917.
	Násik District.	
5	Dindori Surgarcane Show ..	11th February 1917.
6	Chándwad ..	26th and 27th February 1917.
7	Nagarsul ..	5th March 1917.
9	Sukene ..	11th and 12th March 1917.
9	Kherwádi ..	22th March 1917.
10	Mohoj ..	5th April 1917.
	Poona District.	
11	Mándavgaon ..	22nd February 1917.
	Nagar District.	
12	Kopergaon Farm ..	30th—31st March and 1st April 1917.
	Surat District.	
13	Surat Farm ..	10th—20th December 1916.
14	Amalsad ..	6th November 1916.
15	Godsamba ..	10th December 1916.
	Broach District.	
16	Broach City ..	31st August 1916—Milk demonstration.
17	Broach Farm ..	15—30th January 1917—Party demonstration.
18	Jital ..	18th March 1917.
	Panch Mahál District.	
19	Dohad Farm ..	24th—30th September 1917.
20	Shivrájpur ..	26th November 1917.
21	Mankhosla ..	14th January 1917.
	Kaira District.	
22	Ajupura ..	7th January 1917.
23	Traj ..	26th January 1917.
	Ahmedabad District.	
24	Salal ..	15th November 1916.
25	Viramgám ..	22nd December 1916.

23. Gul-*making and ploughing demonstrations.*—Ploughing demonstrations are given in both the divisions in all the districts almost throughout the year in some part or the other. In Deccan, especially in Khándesh and Nagar Districts, the staff is equally busy with *gul*-making demonstrations and recently this kind of work is being introduced in Surat District where the crushing mill and the furnace are far from satisfactory.

During the year under report Messrs. Athalye and Gadgil have done good deal of work in agricultural co-operation in forming seed and manure societies in addition to their ordinary district work.

P. C. PATIL,

Poona, 24th September 1917.

Acting Deputy Director of Agriculture,
Northern Division.

APPENDIX D.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, SOUTHERN DIVISION, DHARWAR, DURING 1916-17.

Staff.

Mr. T. Gilbert having joined the Indian Army Reserve of Officers, I have been acting for him as Deputy Director of Agriculture, Southern Division, since 1st of August 1916. Mr. D. H. Tagare was appointed as Divisional Superintendent of Agriculture, Southern Division, with his headquarters at Sholápur. No substitute has yet been appointed for Mr. Tagare. There have been no changes in the Farm and District Staff except Mr. G. R. Deshpande, Assistant Superintendent, Dhárwár Farm, who is transferred to district work as Overseer at Gadag and Mr. H. B. Kulkarni brought back as fieldman to the same farm. The post of a non-graduate fieldman from Dhárwár is transferred to Gadag as there was no fieldman at the latter. The services of Mr. L. L. Kulkarni are transferred to this Division from that of the Konkan. A second Graduate District Agricultural Overseer was appointed at Chikkodi in Mr. V. S. Kulkarni for Belgaum District but he was soon taken back to the Sugarcane Farm at Mánjri. The services of Mr. V. R. Dharwarkar and Mr. L. N. Deshpande were lent temporarily to the Co-operative Department for organization of Cotton Sale Societies. The Cotton Supervisor was given during the year some of the District Cotton work in addition to his own duties as Mr. Tagare, Divisional Superintendent of Agriculture, Southern Division, living at Sholápur, could not do this work.

The two fieldmen trained under Government Resolution No. 226, Financial Department, dated 18th January 1915, are doing satisfactory work under Chikkodi and Bijápur Associations.

The Demonstration plot at Islámpur has been closed during the year as the experiments conducted on that plot have proved the object for which the plot was started, viz., to show that groundnut is a good rotation crop for jowár. There were no other important experiments in this plot.

General.

The experimental work which was in progress on the Dhárwár and Gokák Farms regarding the systems of land reclamation as practised by the black and light soil cultivators, has solved many difficulties which occurred in the actual execution of such work. With the experience gained on the subject during the year we are now able to take up the work on large scale on the Gadag Farm the area of which is most uneven. The improved system of putting up bunds, with waste weirs and sluice gates, adopted on the Gadag and Dhárwár Farms during the year, seems to work satisfactorily under different conditions in the district. It is intended to introduce this system of bunding, in the district, after the current year's experience on the Gadag Farm during heavy rains.

The future programme of work on the non-experimental area of the farms has been decided, to grow on such area, local crops from selected strains, such as cotton, jowar and wheat, for supplying sufficient seed to a few selected farmers, who in turn will grow and multiply the same in large quantity for general distribution, in the district. Experiments which have led to conclusive results are being summarized in the annual reports of the different farms and the area occupied by these made available for selected strains of the local crops.

Implements.

The progress of introduction of improved agricultural implements in this Division may be seen from the following statement which gives the comparative gross value of implements sold since 1913-14 to the year under report:—

Serial No.	Year.	Gross value of implements sold.	Remarks.
		Rs.	
1	1913-14	4,000	
2	1914-15	6,000	
3	1915-16	26,000	
4	1916-17	38,300	

The details of implements sold by the different Implement Depôts in this Division during 1916-17 are given below :—

Serial No.	Name of Depôt.	Value of implements.	Remarks.
		Rs. a. p.	
1	Dhárwár Farm	8,499 10 2	The implements sold include Iron ploughs, sugarcane mills, gul-pans, chaff-cutters, iron scrapers and spare parts of the above sold in previous years.
2	Gokák Farm	5,121 6 4	
3	Devihosur School	630 5 1	
4	Belgaum Depôt	3,162 6 0	
5	Divisional Superintendent, Southern Division, Sholápur, and his District Staff.	6,970 0 0	
6	Agricultural Association, Bijápur ..	9,148 0 0	
7	Agricultural Association, Athani ..	666 0 0	
8	Agricultural Association, Chikkodi ..	4,117 0 0	
	Total ..	38,314 11 7	

Besides the implements sold to cultivators, there was a great demand for the same on hire. Since last year a few improved implements were specially bought and kept on hire along with those possessed by the Department when not required for demonstrations. As the demand was great during the year, the stock of implements for hire alone was increased and this stock was separated from the stock with the District Staff for demonstration.

Implements stocked worth Rs. 1,866, for hiring purposes alone, realized a hire of Rs. 474-0-6. Besides a sum of Rs. 388-10-0 has been realized as hire from implements with the District Staff for demonstration purposes. The business of keeping implements for hire has been most paying, and is being taken up by almost all Agricultural Associations in this Division and also by sáwkárs. The Dhárwár District Agricultural Association possesses now 35 ploughs for hiring purposes. The accounts of implements hired by all the Agricultural Associations are not shown in this report. The Athani Association has realized Rs. 224-1-0 on 13 ploughs worth about Rs. 600. This Association is adding new ploughs every year to the Association from the amounts realized by hire. In the Sholápur District the Bársi Agricultural Association has a large number of ploughs for hire. Besides Associations, moneyed men at six villages in the Sátára and Sholápur Districts are doing this business with great profit.

The workshop attached to the Dhárwár Farm has been brought during the year under report on business lines. The workshop has made a net profit of Rs. 337-9-1 in the total transactions of Rs. 1,831-4-8 during the year. The chief implements made at the workshop are wheat-threshers and gul-pans and local improved wooden agricultural implements, such as single-bullock harrows, Gujarát cotton drills, improved tail sheet for Sabul ploughs, and some other petty articles.

Shows and Demonstrations.

As stated in the last year's report, competition in ploughing has been instituted at most of the important demonstrations and all Agricultural Shows. Cultivators take very keen interest in ploughing competition. They always like to have their own bullocks and driver though common pair of bullocks are provided for by the Department for all competitors.

Owing to damage to houses in several villages in the Dhárwár and Belgaum Districts, farm demonstration at Dhárwár had to be abandoned as the cultivators found it very inconvenient to attend the demonstration. The power crusher and gul-making on multiple furnaces, the different methods of cane cultivation, and the use of varieties of improved agricultural implements, etc., were demonstrated on the Canal Farm at Arbhávi. Cultivators interested in sugarcane, attended the demonstrations from the three districts of Dhárwár, Belgaum and Bijápur. Cultivators from Sátára and Sholápur were taken by Mr. Tagare to the Sugarcane Farm at Mánjri. District demonstrations numbered 57 this year as against 53 during the last. Many of the district demonstrations were accompanied by ploughing competition and lectures on Veterinary and Co-operative subjects with demonstrations of steeping jowár. The demonstration of the advantages of early castration of bull-calves has begun to be appreciated by cultivators, as evidenced from the fact that a number of young calves are voluntarily brought by them to the spot for the operation just after the demonstration is over.

Besides demonstrations of improved agricultural implements for better tillage of lands, a new method of inducement for growing good crops was instituted during the year, by offering prizes for good crops raised by cultivators under competition. This was undertaken by the Village Agricultural Association of Kurtkoti and the District Agricultural Association of Bijápur. The former had selected D. A. cotton and the latter local wheat. Conditions for competitors were printed and distributed. Only such cultivators whose applications were received before sowing the crops were allowed to compete. The amount of prizes awarded

was Rs. 100 by each association. Half of this sum was contributed by the Agricultural Department. There were 15 competitors at Kurtkoti for cotton crop, each growing the crop on not less than 10 acres. Thus with a small amount of Rs. 100 offered in prizes about 150 acres of cotton was seen under most careful cultivation. The points on which the D. A. cotton crop under competition was examined were as below :—

	Points.
For anna valuation of crop	30
For clean cultivation	20
For straight sowing	10
For purity of the variety (free from mixtures of other variety).	20
For good stands of plants in row	20

The method of offering prizes for crop competition seems to bring in improvements in agriculture in all ways very rapidly and the example set forth by the Kurtkoti and Bijápur Associations is worth being followed by other associations. The Sholápur Association has taken up the idea during the current year and the following crops are selected for competition :—

(*a*) Sugarcane.
(*b*) N. R. Cotton.
(*c*) Rabi Jowár.

The details of copper sulphate packets distributed in this Division are shown in the following statement :—

Serial No.	Name of district.	No. of packets sold.	Remarks.
1	Dhárwár	7,900	In the whole Division Dhárwár District stands first. Haveri Táluka alone has used nearly 3,500 packets out of the total 7,900 packets. This is due to the efforts of the Mámlátdar of that táluka.
2	Belgaum	2,900	
3	Bijápur	3,900	
4	Sátára	1,100	
5	Sholápur	2,100	

GRAFTING CLASS AT SATARA.

The increasing tendency for planting mango grafts in suitable places in the Division, and the eagerness of the mango planters to know the different methods of grafting, induced the Department to open a short class during the year at Sátára. The class was attended by educated people who own mango gardens and who intend to extend the existing plantations or start new ones. A similar class is proposed to be opened at Dhárwár in November next. The Vice-President of the Dhárwár District Agricultural Association, Mr. S. V. Desai, has taken the lead for this class.

During the year under report 618 mango grafts, 125 plants of sour lime and 87 plants of Santra oranges were distributed by the Department at cost price. Besides these a number of mango grafts are ordered from Bangalore and Salem direct by cultivators.

Apart from District Demonstrations, a number of demonstrations showing improved methods of cultivation, manuring, irrigating, etc., are undertaken in cultivators' fields. The improved method of sugarcane cultivation in long rows as worked out at Mánjri and the application of Ammonium sulphate and oil-cake as a top dressing for sugarcane, are demonstrated in cultivators' fields in various places. The new method of planting cane is now introduced in 28 villages in the Sholápur and a few villages in the Sátára and Belgaum Districts. Similarly the single and double improved furnaces are built at several cultivators' sugarcane gardens throughout the Division.

Distribution of Seed and Manures.—The following are the details of seeds distributed in the Division :—

Serial No.	Name of seed.	Quantity distributed in lbs.
1	Broach cotton seed local	7,975
2	Broach from Navasári	4,404
3	Kumpta cross cotton seed	2,454
4	Cambodia cotton seed	22,670
5	N. R. Cotton seed	8,000
6	Kumpta ordinary seed	22,997
7	Kumpta selected cotton seed	171
8	Groundnut seed	2,874
9	San seed	4,100
10	Jowár seeds (including fodder varieties) ..	1,236
11	Lucerne seed	40

The value of good seed is now being appreciated by cultivators. They do not grudge to pay higher rate than bazar for seed grown on the farm or otherwise obtained through special arrangements of the Department.

The demand for artificial manure and for oil-cake has, recently very largely increased in the Sátára District for top-dressing sugarcane crop. The Divisional Superintendent of Agriculture, Mr. Tagare, is inducing the local societies and private gentlemen to take up the work of supplying these to cultivators at small profits which is fixed by Mr. Tagare. He also supervises the whole operation of purchasing and distribution. This obviates the departmental investment of money in the transactions. The following statement gives an idea of the growing demand for artificial manures for sugarcane :—

Serial No.	Name of manure.	Distributing agency.	Quantity.
1	Ammonium sulphate ..	Mr. Dhavle of Retra ..	35 tons.
2	Do. ..	Divisional Inspector, Sholápur ..	13 ,,
3	Groundnut cake ..	Koregaon Society ..	100,000 lbs.
4	Do. ..	Petha Society ..	100,000 ,,
5	Do. ..	Supane Society ..	5,000 ,,
6	Do. ..	Mr. Dhavle of Retra ..	250,000 ,,

In the Sholápur District the use of cake is recently taken for manure purposes. Only 30,000 lbs. was distributed by the Department. The demand seems to increase up to 100,000 lbs. during the current year.

Crops.

Cotton.—The area under Broach cotton is not increasing rapidly owing to difficulties of marketting and of importing fresh seed every year. The cultivation of Cambodia is gradually extending. However, there seems to be a limited area for these two new cottons. But the selected strains in Kumpta and Dhárwár-American (Upland type) have large tracts before them for being substituted in place of the local Kumpta and Dhárwár-American (mixed with Upland and New Orlean types). A suitable scheme for multiplying the seeds of selected strains through registered seed growers is made and accordingly quantities of seeds available are distributed during the current year. Similarly arrangements are under progress for multiplying N. R. cotton seed in the Sholápur District. The following are the remarks of Messrs. Forbes, Forbes & Co. to whom a sample bale of selected strain of Kumpta cotton was sent for spinning test :—

" The cotton was considerably superior to any of the Kumpta cottons as supplied either direct by the rayats or which we have obtained from the near markets. It is bright, clean, long in staple and uniform and of middling strength ; from it we spun 3 counts, viz., 20*s*, 30*s*, 40*s*; the yarn ran smoothly and demanded very little attention from the work people and we would no doubt have received better results had we had sufficient cotton to make it worth our while to alter our machinery, so that it should be spun into yarn under the best conditions.

" The loss percentage in the blow room amounted to 8 per cent. The yarn gave the following tests :—

Count.	Actual average count.	Actual average strength.
		lbs.
40*s*	38·4	34¾
30*s*	30·3	46½
20*s*	19·5	82¼

" Against this we give you the result of 20*s* spun from Kumpta and other cotton from the places named :—

Name.	Blow room loss.	Average count.	Strength.
	%		lbs.
Kudchi ..	9½	20·4	59½
Hubli ..	10	19·6	65
Athani ..	11	20·6	59½
Shedbal ..	10½	20·6	59½
Jamkhandi ..	12	19·5	62
Mudhol ..	14	19·6	69
Bágalkot ..	14	20·1	60
Bijápur ..	13½	19·6	68
Sángli ..	13½	20·2	65

"The cotton you supplied is better than Cambodia we have seen this year and fully Rs. 20 per khandy better than Kumpta as from the surrounding districts."

Sugarcane.—A new method of planting small sets with a single eye bud on it, with the eye placed upwards in the improved long row system, instead of in small beds, is under experiment on the Dhárwár and Gokák Farms. From the standing crop at present, this new method seems to have very great future before it. In this system all tillers are removed and only the shoots coming direct from the eye bud originally planted are allowed to develop into big cane. The following are the advantages in this system :—

(1) Each eye bud being cut separate there is better selection of seed.

(2) The eyes being placed upwards germination is early and the plants get an earlier start than in the local method.

(3) The canes go straight up instead of growing in slanting direction and consequently interculture and other operations are facilitated.

(4) All tillers being removed the mother canes develop into thicker and longer canes.

(5) There being no tillers and all mother canes having germinated at one and the same time, all canes mature at one and the same time, while in the local system mother and tiller canes mature irregularly at different times.

(6) All the tillers having been removed no useless plant remains to feed on the valuable manure. Thus it is likely that less manure might be sufficient to get the maximum crop.

(7) In fact, the object of this system is to get as many number of good canes as the eye buds are originally planted. It is estimated to get up to 40,000 good canes per acre.

The only disadvantage in this method is to cut an enormous number of small pieces of sets for planting. But this difficulty and the extra cost of cutting seems (from the standing crop) to compensate several times, by the higher yield expected from the crop.

The new system under trial has given several other new ideas about the quantity of artificial manures to be given and the time of top dressing, etc. Experiments in connection with these will be undertaken after the present crop is harvested and actual yields obtained.

Magazine.

The Dhárwár District Agricultural Association continues to publish its Kánarese agricultural magazine. A few extra pages are now specially assigned for co-operative subjects for which the Co-operative Department gives an annual grant of Rs. 300. The title of the magazine is changed from "Vakkaligaru Vakkalatanavu (Agriculturists and Agriculture)" to "Vakkaligaru and Sahakaritanavu (Agriculturists and Co-operation)." The number of private subscribers to the magazine is gradually increasing and its financial position is now satisfactory. The Graduate and Non-graduate staff of the Department have now undertaken to edit the magazine with Mr. Shevade as their head. The work was most satisfactorily done throughout the year.

Vernacular Agricultural School at Devihosur.

The extension of age limit from 16 to 18 for admission of students into the school, as reported in last year's report, has solved the difficulty of sufficient number of boys to the school.

The first batch of successful students from the school has returned home. It is gratifying to note that the majority of the students have taken home cultivation on improved methods.

Ráo Sáheb Shetti's sympathy for the school is extended by a further grant of the land for play-ground to the school children.

Acknowledgements are again due to—

(1) The Sir David Sassoon Fund Committee,

(2) The Lingayat Education Committee,

for the contribution of Rs. 1,000 and 240 respectively and also to Messrs. B. Y. Hulkoti and Nabisaheb Nadaf of Tavarmallihalli. The former has contributed Rs. 120 and the latter has deposited Rs. 1,000 in the Karnátic Central Bank for utilization of the interest (Rs. 60) thereon every year for the maintenance of the school.

Tegur Farm.

The stock have increased from 20 cows, 2 heifers, 12 bull-calves and 25 cow-calves on the 31st March 1916 to 28 cows, 18 bull-calves and 23 cow-calves at the end of March 1917. For the sake of facility in keeping Cattle Register the intermediate stage of heifers between calves and cows is removed. Two early castrated bull-calves, transferred during the last year to the Dhárwár Farm for stall feeding, have turned out into excellent young bullocks. They are now being trained for light work.

There has been a great improvement in the hay and silage made from spear grass. This is the result of experience in the silage making which was quite new to this part some time ago. Experiments with various varieties of new grasses are under progress. Definite results have not yet been obtained. As reported in last year's report mixtures of perennial and annual are being grown on sufficiently large plots to test yields and for other observations on the subject.

Agricultural Associations.

The Bijápur Association has continued its useful work of distribution of ploughs. The small farm maintained by this association is doing useful work. The association has during the year got a man trained in dry farming at the Poona Agricultural College and has taken up a small plot for experiment. The Dhárwár District Agricultural Association has taken up the work of distribution of superior qualities of seeds on large scale and of hiring out implements. Among the smaller associations, Athani and Chikkodi in the Belgaum District, Kurtkoti in Dhárwár and Bársi in the Sholápur District are doing useful work. The ploughing competition held during the year under report and the prizes advertized for competition of crops during the current year are the proper directions of work undertaken by the Sholápur Association.

The Belgaum Association has moved a little forward in opening an implement depôt with the aid of the Department. There is great scope for work at Belgaum if the Association is properly organized. This association is yet far behind when compared with other associations.

Experimental trials of crops and manures, etc., which have given conclusive results on Government farms, are being summarized and published in the annual reports of the respective farms.

Publication of Leaflets and Bulletins.

The bulletin on rice investigation and the preliminary note on wire fencing referred to last year were published during the year under report. Material for a bulletin and two leaflets on the cotton work done in the Southern Division so far, and the methods of silage and hay-making at Tegur from spear grass and of stone roller for threshing jowár, are supplied and they will be published during the current year.

To conclude, the staff on the whole have worked most satisfactorily. Among the old members of the staff the work of Messrs. Tagare and Shevade deserves special mention, as the former with his meagre staff has done good work in the district and the latter has managed the Central Farm at Dhárwár to my entire satisfaction.

To the list of junior members, whose work has already been approved, the names of Messrs. I. S. Kulkarni (graduate-fieldman) and L. N. Deshpande (Clerk field-man in the Office of the Divisional Inspector of Agriculture, Southern Division, Dhárwár) may be added.

As I was in charge of both the Offices, viz., Deputy Director and Divisional Superintendent, the Southern Division, Dhárwár, there was considerable increase of work in the office, which was most satisfactorily and promptly disposed of by my Head Clerk, Mr. Bramhe, and Camp Clerk, Mr. Onkar.

M. L. KULKARNI,
Acting Deputy Director of Agriculture,
Southern Division.

APPENDIX E.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE IN SIND, FOR THE YEAR 1916-17.

ORGANIZATION.

1. The Department of Agriculture in Sind is represented by one Deputy Director of Agriculture an done Divisional Superintendent of Agriculture together with a staff of Assistants as noted in the following statement :—

Graduates.			Non-graduates.		
Number.	Grades.	Scales of salary.	Number.	Grades.	Scales of salary.
8	IV	75—5—100	2	I	50—2—60
2	IV	40—50—60 and on confirmation	2	II	35—2—45
			9	III	20—2—30
		75—5—100	1	Special posts.	75—5—100.

There are four experimental farms at the marginally noted centres and one seed farm of 200 acres at Mirpurkhás.

Mirpurkhás.
Sukkur.
Lárkána.
Landhi.

The District work is conducted through the Divisional Superintendent of Agriculture assisted by 6 District Agricultural Overseers.

Agricultural education is provided for by a school at Mirpurkhás under the management of a Head Master, a graduate of the Poona Agricultural College.

The Budget of the Department in Sind for the year 1917-18 amounts to Rs. 92,997 as follows :—

	Rs.
Salaries of officers and staff	.. 36,192
Contingencies	.. 56,805

SEASON.

2. *Inundation.*—The river rose very late, being some three weeks behind time, when the normal level was reached. It remained fairly steady, if low, during the months of July and August but fell rather abruptly in early September. The maxima gauge readings were as noted in the margin. Rice transplantation on the Lárkána Farm with flow water from the Abro wah, a branch of the Ghár Canal, became possible on the 18th July and the final irrigation was given on the 10th September which was 48 days before harvest in the case of Kangani rice, an early variety, and 70* days before Jagai-Sugdasi, a late variety, was harvested. The Jamrao Canal worked poorly. The preceding rabi rotations extended to the 12th June 1916, when the supply was for one week in four. Rotations again commenced on the 8th October 1916 and continued gradually widening till the canal was closed for clearance. The close-period in the case of the Mirpurkhás Farm lasted from the 19th February to the 1st June 1917.

Name of Gauge.	Reading in feet.	Date.
Attock ..	43	8th August 1916.
Bukkur ..	13·8	17th August 1916.

Rainfall.—In Lower Sind there were heavy rains in August-September ; nearly five inches out of a total fall for the year of 7 inches fell in the second fortnight of August at Mirpurkhás. At Jamesabad and Nawábshah there was much more rain, approaching to some 20 inches. There were no useful cold weather rains.

Temperature.—There was no frost and the cold weather departed somewhat prematurely. On the other hand, the maxima temperatures were lower than normal and the hot winds of the " Chaliho " period did not last so long as usual, though severe for a few days.

The impress left on agriculture by the conditions noted above was in the following directions. Wheat, which is always irrigated on the Jamrao Canal, suffered severely. Kharif sowings were delayed a good deal and the cotton area of the province was over 30 per cent. below its five years' average ; on the other hand, the rice area was well maintained. American cotton became badly attacked by red-leaf blight and there was a rather severe attack of boll-worm in deshi cotton in the Mirpur Sub-division. There were some signs that the borer (*Chilo simplex*) was less severe on jowár in Upper Sind Frontier Province, but gram suffered severely in this district from pod-borer (*Chloridea obsoleta*).

* Owing to sickness, etc., the harvest was delayed perhaps a fortnight.

American Cotton in Sind.

3. At one time there seemed little likelihood of this cotton being sown on the Jamrao in 1916 but in April the Bombay Syndicate, which had operated as a buying agency in 1912-13, 1913-14 and 1914-15, decided to reorganize itself and recommence operations on new terms with Government. The chief features of the new scheme were (1) that Government should share half the loss, if any, incurred in the season's transactions, (2) that the Syndicate should be allowed to supplement its operations in American cotton with dealings in deshi cotton so as to give full employment to its men and machinery, (3) that the Director of Agriculture should become *ex officio* a member of the Syndicate, (4) that the Syndicate should pay a premium for American cotton equal to its full intrinsic value without consideration of the small quantity being handled. The actual management of the Syndicate's affairs passed into the hands of Messrs. Tata Sons & Co. and a considerable all-round improvement was noted in the business methods adopted. A permanent manager remained at Mirpurkhás from mid-September throughout the season; purchases commenced in good time on the 7th October 1916; the convenience of cultivators at a distance was studied by deputing sub-agents to make purchases at Jamesabad and elsewhere. On the other hand, the cotton brought in by cultivators contained very little admixture of deshi cotton.

All these factors made for success but there were two others which rather marred the season's operations. (1) The exceptional rains in August proved very harmful to American cotton. As a consequence there was shedding of buds and bolls and red-leaf blight affected the crop as it had never before been observed to do in Sind and thus the average outturns ruled very low except at Jamesabad where crops of 6 maunds (480 lbs.) of seed-cotton per acre were reported. The Seed Farm only averaged some 3½ maunds per acre but here the crop was also damaged by white ants, not to mention kalar, while weed-growth proved very troublesome. (2) The premium of Rs. 2-5-6 per maund fixed by the Syndicate when they started buying operations was rather a disappointment. As deshi cotton was commanding a price of Rs. 10 per maund* this premium failed to reach by a couple of points—the minimum of 25 per cent. which was considered necessary to induce zamindárs to go in for American cotton. About half the total crop changed hands at this premium but the Honourable Mr. Bhurgri and one or two other zamindárs who produced the other half were more successful in striking a bargain. They succeeded in securing a price of Rs. 13-15-0 per maund when the current price of deshi was Rs. 10-8-0, so that they realized a premium of Rs. 3½ per maund or 33 per cent. Mr. Bhurgri, however, was in a strong position as he possessed a ginning factory and would probably have converted his seed-cotton into clean-cotton if the Syndicate's price had failed to satisfy him. The Syndicate were anxious to obtain his cotton owing to its being a big lot and actually bid him Rs. 15 per maund, a short time previously, when the price of deshi had passed Rs. 11 per maund. These prices should be considered with reference to those ruling in the Punjab. There, a premium of Rs. 4 per maund was common and Punjab-American cotton is not superior to Sind-American in quality; at Okara auction sale (Montgomery District, Punjab) held on the 23rd November 1916 prices for American cotton ranged upto Rs. 15-13-0 per maund according to freedom from deshi mixture when the price of deshi was Rs. 9-8-0 per maund, while four days later Rs. 17-1-0 per maund was obtained at another auction sale.

It would seem that the premium paid for Sind-American by the Syndicate approximated to the minimum premium obtained in the Punjab for lots badly mixed with deshi cotton.

Altogether 27,040 lbs. of Triumph American seed of excellent quality, all produced and ginned on the Seed Farm in the previous season, were distributed mostly on the Jamrao. Over 650 acres were sown in the marginally noted tálukas. The Syndicate purchased 2,510 maunds of (83 lbs.) of seed-cotton equivalent to 176 bales.

Name of táluka.	Acres	Gunthas.
Digri ..	65	0
Sinjhoro ..	33	15
Mirpurkhás ..	236	0
Jamesabad ..	290	29
Nawábshah ..	28	0

4. In last year's report attention was drawn to the valuations of and reports upon the American lint, which showed that after a period of three years' acclimatization there was no falling off in quality. On the other hand, in the year under report there was evidence that the adverse season had caused a deterioration in the development of the plants. Mr. Henderson, late Deputy Director of Agriculture in Sind, who imported the seed from America in 1913-14, inspected the crop at the close of the season (February 1917) and expressed the opinion that the crop was not Triumph but a mixture containing a small-bolled type of cotton. A reference to the history of the seed shows, however, that previous to this season only on one occasion since its introduction was a small quantity† grown on the same farm where other American

* The maund is 82 lbs. but some firms demand 83 lbs.

† The produce of 2 acres.

cottons were cultivated while no mixture of American types at the ginning operations was possible.* No doubt bolls tend to diminish in size in winter but it is probable that something of the original size has been lost by cultivation in Sind and a very noticeable feature of the season's crop was the poorly developed seed: fully 20 to 25 per cent. of small seed could be picked out of a handful taken at random; this was remarkable in view of the fine quality of the seed distributed last year; it appears in fact that the poor quality of the seed may prove to have been merely a seasonal effect accentuated by the diseased condition into which the crop fell after the wet weather of August 1916.

5. An attempt was made to conduct a comparative experiment on a large scale on the Seed Farm between Triumph, Deshi and N. R. Cottons. Unfortunately uniformity of soil, on areas of six acres, is not possible and hence the following results should not be accepted as final :—

Yield in lbs. per acre of seed-cotton.

Triumph American.				N. R.				Bhitshah or Deshi.			
Numbers of plots.				Numbers of plots.				Numbers of plots.			
V-1†	V-2	V-3	V-4	IV-2	IV-3	IV-4	IV-5	III-3	III-4	III-5	III-6
800	508¾	688	650	521¼	620	831¼	1,185¼	573¾	698	678	861¾
	average 641				average 789¼				average 701		

This experiment was conducted in three parallel strips of land of six acres each. It will be noted that individual plots vary greatly: thus N. R. yields twice as much on plot IV-5 as on IV-2. The averages indicate a superiority of 23 per cent. for N. R. over Triumph and of 10 per cent. for deshi over Triumph which, so far as it goes, is more favourable than the provisional figure of 25 per cent. put forward last year.

On the Seed Farm 75 acres were sown with Triumph and an average yield of 286½ lbs. of seed-cotton per acre was obtained. This low outturn, which must be largely ascribed to the season and its consequences and also in part to the presence of a good deal of kalar in many plots, is significant and must influence the grower of large areas of cotton in his search for a profitable variety.

6. Reference was made in paragraph 4 above to signs of deterioration in the plant. As regards the fibre the report of Messrs. The New Kaiser-i-Hind S. & W. Co., Ltd., to whom the Syndicate delivered the cotton, does not suggest any deterioration on last year's crop :—

> "It was used in a warp mixing to the extent of 14 per cent. and the yarn spun out of the same was of No. 22*s* count, with a strength of about 68 lbs. We think if the cotton had been used by itself we could not have got any better result than the above. We are sorry we could not conveniently try this cotton by itself."

If this report implies that a 22*s* yarn could have been spun out of Sind-American cotton (used alone) then the result compares favourably with the trial spinnings made last year in which the following results were obtained :—

Trial.	Twist intended.	Exact count obtained.	Tension in lbs.	Remarks.
A ..	20*s*	20·01*s*	60·30	Average of 100 warpings.
B ..	24*s*	24·11*s*	45·50	Average of 120 warpings.

Mr. Bazonji who made these tests in Nágpur concluded that the Sind-American cotton was not suited to a good strong 22*s* or 24*s* warp but he drew attention to the presence of bunches of short fibres in this cotton, due probably to defective saw-ginning.

In the season under report the Syndicate roller-ginned the Sind-American cotton and perhaps this accounts for a tension of 68 lbs. being obtained from a 22*s* count. It should be added that the local agent at Mirpurkhás reported that in Bombay the fibre was not found to be so silky to the touch as American lint ought to be and that the staple was not of uniform length.

*This narrows the issue to the possibility of the original stock of seed imported not being pure which is possible in view of the consignment amounting to 30 or 40 tons.

† This plot was 0·9 acres. The rest were 1·5 acres in area.

Two samples of Sind-American (Triumph) cotton grown on the same plot of the Mirpurkhás Farm were forwarded to the Bombay Cotton Trade Association for favour of valuation. The Association's report was as follows and is of much interest in indicating the extent to which the value of cotton is affected by the gin :—

Description of sample.	Approximate market value in Rs. per candy of 784 lbs. less 5½% discount.	Remarks.
Saw-ginned ..	525	Sample quite regular and is a distinct improvement to the ordinary run of Sind-American in the Bombay Market.
Roller-ginned ..	435	Cotton appears very badly ginned as if knives not properly adjusted and it is feared that staple has suffered in consequence; seed very excessive.

The roller gin was the hand Surat gin and the saw gin was that of the Seed Farm. The basis of valuation was as noted in the margin.

	Rs.
M. G. Sind-American ..	475
Cambodia	525

Other Cottons.

7. In the light of this season's experience it seems necessary to discover a cotton of the American variety which is resistant to red-leaf blight. There appear at present two such cottons—(1) Cambodia and (2) Punjab F-4. The former is a very robust, strong growing cotton, largely resistant to this disease. It is, however, late in maturing. F-4 is the cotton which is proving so successful in the Punjab and which is said to be largely immune to red-leaf blight under Punjab conditions, due, it is said, to the possession of a hairy leaf. This characteristic is strongly possessed by Cambodia cotton. Cambodia gave a yield of 727 lbs. of seed-cotton per acre on the Seed Farm but only 302 lbs. on the Mirpurkhás Farm. At Landhi it yielded at the rate of 1,172 lbs. of seed-cotton per acre. There are great possibilities in this cotton where early sowing is possible. F-4 did not get a very good chance owing to kalar; it developed red-leaf blight a good deal on the Seed Farm but not so much as Triumph did. A further trial will be given to it.

Name of place.	Yield of seed-cotton in lbs. per acre.	
	N. R.	Deshi.
Sukkur Farm ..	1,056	800
Lárkána Farm ..	1,201	Not grown
Jamesabad Plot ..	1,288	810
Mátli Plot ..	992	963
Shikárpur Plot ..	644	500
Nawábshah Plot ..	193*	564
Seed Farm ..	790	701

*Injured by a field cricket (*bokhra*).

8. N. R. or selected Khándesh was given a trial in comparison with Bhitshah or the best Sind deshi at several centres and did very well. Acreage yields obtained at different places are noted in the margin; in the year under report the ginning percentages of these cottons, grown on Mirpurkhás Farm and ginned in a local factory, were Bhitshah (41·7 per cent.), N. R. (41·1 per cent.).

At other centres, markedly in North Sind, the ginning percentages were much lower.

Samples of these cottons were forwarded to the Bombay Cotton Trade Association who reported as follows :—

Serial No.	Description.	Where grown.	Approximate market value in Rs. per candy of 784 lbs. less 5½% discount.	Remarks.
2	Saw-ginned Sind Cambodia..	Mirpurkhás ..	495	Dull in colour, somewhat leafy, staple irregular and not so good as No. 3.
3	Do. do. ..	Sukkur ..	525	Best in staple as regards length but perhaps slightly weaker than No. 2, very silky and glossy.
4	Do. do. ..	Landhi ..	515	Best in class, length in staple slightly less and weaker than No. 3.

Addition to paragraph 6.

Duplicate samples of the cotton were forwarded to the British Cotton Growing Association whose Brokers reported as follows :—

Basis—Middling American	..22·00*d.*
Fine Surtee Broach	..21·75*d.*
Good Tinnevelly	..21·38*d.*

I-A.—Saw Ginned.—(This lot stands out and is a great advance on Indian Cotton.) "Clean, good colour, staple rough in character $1\frac{1}{8}$" some short fibre, strong. Value 22·50*d.*"

I-B.—Roller Ginned.—"Dull, leafy, staple irregular about $1\frac{1}{16}$" but mixed with short. Value 20·00*d.*"

In forwarding these valuations Mr. Arthur Hutton, Chairman of the Association, remarked : "I must confess that I cannot understand why I-A should turn out so much better than I-B, but the fibre is distinctly longer and the difference between cotton $1\frac{1}{16}$" and $1\frac{1}{8}$" is enormous, for there is a very great demand for cotton of the greater length, as this is the general class of cotton which is most used in Lancashire."

Serial No.	Description.	Where grown.	Approximate market value in Rs. per candy of 784 lbs. less 5½% discount.	Remarks.
5	Roller-ginned selected strain from deshi-Khándesh *	Seed Farm ..	325	All very poor in staple and No. 8 very poor in class; shorter in staple than any recognized Indian growths.
6	Do. do.	Lárkána ..	325	
7	Do. do.	Sukkur ..	325	
8	Do. do.	Jamesabad ..	310	

Sindhi white (*thori*)	1,456
Sindhi red	1,421
Mundi	1,217
Tomra	1,006
Special Pusa 12	1,680

wheats. Some excellent outturns were obtained on the Seed Farm as noted in the following statement :—

Name of variety.	Area cropped.	Yield per acre in lbs.		Remarks.
		Grain.	Chaff and straw.	
Pusa 12 (Home seed)	12¾	1,371	1,740	Soil ⅓rd rather stiff, ⅔rd free-working.
Pissi (Home seed)	5	1,733	1,609	Soil rather stiff.
Pissi (partly Home, partly Hoshangabad seed)	7	1,147	1,661	Some kalar in plots.
Punjab 11	3	1,240	1,690	Soil rather stiff.

11. In North Sind kalar interfered with wheat work but the results obtained favoured the local varieties. On Sukkur and Lárkána Farms the following yields were obtained from irrigated wheat grown on a half-acre scale :—

Name of variety.	Yield in lbs. of grain per acre.		Remarks.
	Sukkur.	Lárkána.	
Pusa 12	1,304	880	
Pissi	1,144	680	
Thori	1,904	Not grown	
Kahno	Not grown	1,228	

Addition to paragraph 8.

Duplicate samples of numbers 2 and 3 (Cambodia) were forwarded to the British Cotton Growing Association whose Brokers reported as follows :—

Basis—Middling American	..22·00*d.*
Fine Surtee Broach	..21·75*d.*
Good Tinnevelly	..21·38*d.*

Sample 2.—" Clean, good colour, staple about $1\frac{1}{16}$". Value 20·50*d.*"

Sample 3.—" Clean, fair colour, staple about $1\frac{1}{16}$" but rather soft and irregular. Value 20·00*d.*"

Serial No.	Description.	Where grown.	Approximate market value in Rs. per candy of 784 lbs. less 5½% discount.	Remarks.
5	Roller-ginned selected strain from deshi-Khándesh *	Seed Farm ..	325	All very poor in staple and No. 8 very poor in class, shorter in staple than any recognized Indian growths.
6	Do. do.	.. Lárkána ..	325	
7	Do. do.	.. Sukkur ..	325	
8	Do. do.	.. Jamesabad ..	310	
9	Roller-ginned deshi-Sind	.. Mirpurkhás ..	335	A little better in staple than above; class fine.

* This is N. R.

The Cambodia cotton was ginned on the hand saw gin of Mirpurkhás Farm and the other cottons were ginned by a hand roller gin (the Surat gin) which possibly was not in proper adjustment. The basis of valuation was as shown in the margin.

	Rs.
M. G. Khándesh	405
M. G. Sind	345

9. *Selection.*—Work on the selection of deshi cotton which consists of a mixture of several types is being pushed on at Mirpurkhás where it is hoped to isolate a local white-flowered type which will prove superior even to N. R. from Khándesh.

Wheat.

Name of variety.	Yield in lbs. of grain per acre.
Kalakasal ..	1,309
Pusa 4 ..	1,092
Sindhi white (*thori*) ..	1,456
Sindhi red ..	1,421
Mundi ..	1,217
Tomra ..	1,006
Special Pusa 12 ..	1,680

10. Trials on a large scale were given to Pusa 12 and Pissi and Punjab 11 wheats and on a small scale to the marginally noted wheats. Some excellent outturns were obtained on the Seed Farm as noted in the following statement :—

Name of variety.	Area cropped.	Yield per acre in lbs.		Remarks.
		Grain.	Chaff and straw.	
Pusa 12 (Home seed) ...	12¾	1,371	1,740	Soil ⅓rd rather stiff, ⅔rd free-working.
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Pissi (partly Home, partly Hoshangabad seed) ..	7	1,147	1,661	Some kalar in plots.
Punjab 11 ..	3	1,240	1,690	Soil rather stiff.

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Thori ..	1,904	Not grown	
Kahno ..	Not grown	1,228	

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Sample 3.—"Clean, fair colour, staple about $1\frac{1}{16}$" but rather soft and irregular. Value 20·00*d.*"

Serial No.	Description.	Where grown.	Approximate market value in Rs. per candy of 784 lbs. less 5½% discount.	Remarks.
5	Roller-ginned selected strain from deshi-Khándesh *	Seed Farm ..	325	All very poor in staple and No. 8 very poor in class, shorter in staple than any recognized Indian growths.
6	Do. do.	.. Lárkána ..	325	
7	Do. do.	.. Sukkur ..	325	
8	Do. do.	.. Jamesabad ..	310	
9	Roller-ginned deshi-Sind	.. Mirpurkhás ..	335	A little better in staple than above; class fine.

* This is N. R.

The Cambodia cotton was ginned on the hand saw gin of Mirpurkhás Farm and the other cottons were ginned by a hand roller gin (the Surat gin) which possibly was not in proper adjustment. The basis of valuation was as shown in the margin.

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Sindhi white (*thori*) ..	1,456
Sindhi red ..	1,421
Mundi ..	1,217
Tomra ..	1,006
Special Pusa 12 ..	1,680

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Name of variety.	Yield in lbs. of grain per acre.		Remarks.
	Sukkur.	Lárkána.	
Pusa 12 ..	1,304	880	
Pissi ..	1,144	680	
Thori ..	1,904	Not grown	
Kahno ..	Not grown	1,228	

12. On the whole, especially at Mirpurkhás, Pissi appears to be the most prolific of the introduced wheats, which confirms last year's results but unfortunately this variety cannot be recommended for cultivation in Sind, at least where the standing crop is irrigated, because it has proved very susceptible to severe attacks of rust at a number of centres. Pusa 12 may establish a claim to cultivation on account of its high quality and attractive appearance but in point of yield it may find some difficulty in competition with the best local varieties.

13. Selection both in local and introduced varieties is in progress with a view of securing prolific pure strains of each. The local wheats of Sind are very mixed and are difficult to test in comparative experiments on that account.

Rice.

14. Comparative trials conducted at Lárkána confirm last year's result that Jagai is the most prolific of the Sugdasi class of rices. On the same farm trials resulted in Sathri proving the earliest variety, being ready for harvest a full fortnight before Kangani although transplanted a few days later.

Berseem.

15. At Mirpurkhás this crop did not receive sufficient irrigation to do itself justice but at Sukkur some striking results were obtained. On this Farm 22 acres sown with berseem yielded produce worth Rs. 2,100, a figure which could have been greatly exceeded had not the cropping scheme necessitated the sacrificing of much of the crop on several plots. As an example of what results can be obtained with berseem under favourable conditions it will be interesting to report in detail the return obtained from an one-acre plot. In this plot the seed was sown on the 29th October and five cuttings were obtained as noted in the margin. The first four cuttings were weighed while the last one was estimated. There seems no reason to doubt that under similar conditions where berseem commands a ready sale of 6 annas per maund (of 80 lbs.) a gross income of Rs. 200 per acre can be realized from berseem cultivation, in a period of seven months.

Date of cutting.	Yield of cutting in maunds of 80 lbs. per acre.	Value of cutting in Rs. per acre.
2nd February 1917 ..	175	50 8 0
17th March 1917 ..	239	65 0 0
3rd April 1917 ..	217	73 1 0
7th May 1917 ..	141	47 7 0
30th May 1917 ..	70	20 15 5
Total ..	841	256 15 6

16. On the Sukkur Farm this crop requires about 20 waterings during its period of cultivation and growth appears to be at its maximum in the month of March; after March yields fall away with the advent of the hot weather until the crop dies off in May. Experience indicates that seed production is difficult in Sind, due perhaps to inadequate fertilization of the flowers but also, it seems probable, to the rapid rise of temperature in April when the seed should be swelling. At any rate, the seed when produced appears to be of inferior quality—a comparative trial on a small scale at Sukkur resulted in freshly imported Egyptian seed yielding 30 per cent. more green fodder than home-produced seed. This is to be regretted because imported seed last year had to be sold at Rs. 20 per maund (80 lbs.) to cover expenses.

Sugarcane.

17. At Sukkur the most promising cane tried was striped Mauritius; it was only grown on a small scale but it appeared to suit the conditions much better than Pundia or even the varieties commonly cultivated, viz., Lahori and local. In this variety the internodes are long and the cane appears to be much less susceptible to borer (*Chilo simplex*) attack than the local varieties. An offer of Rs. 50 was received for an area of 3-40ths of an acre; this was for chewing purposes but the variety seems suitable for crushing also. The Brix Saccharometer gave readings of 19° and 21·5° in the first and third weeks of February respectively which indicates mid-February as the maturing time for cane sown in the early part of the preceding March. The same variety has given promising results at Landhi on a small scale and hence it may prove a "find" for Sind. Five canes were obtained from the Plant Breeding Station in Madras under Dr. Barber; these were tried at Sukkur and out of them Java 33A grew very satisfactorily and it is receiving a further trial at the present time.

Fruit.

18. A new orchard of 2½ acres has been established at Mirpurkhás with the special object of working out the commercial possibilities of certain varieties of fruit which have done well on a small scale. These are grapes, oranges and peaches, while mangoes are being established in an old orchard area. On a smaller scale the marginally noted fruits are being similarly studied. Grafted Pyari mangoes established a few years ago bore a small crop of fruit in the year under report. Some of the best known fruit centres in Sind, such as Tarushah in Nawábshah District, Shikárpur, Lárkána and Hyderabad, are being studied by various members of the Department.

Dates, figs, plums, apples and pears.

At Lárkána an attempt has been made to establish a Mango Orchard but "kalar" has impeded progress. This is an important mango centre but the art of grafting is not known. The demand from the public for fruit stock is developing.

307 Lemon seedlings.
130 Grape-vine cuttings.
124 Grafted mangoes.
115 Mango seedlings.

The principal sales during the year are noted in the margin.

ROTATIONS.

19. The problem of working out a suitable rotation, where perennial irrigation exists and continuous cropping is possible but manure is not available, is engaging special attention at Mirpurkhás.

20. At Landhi the problem is to find a suitable rotation crop for potatoes. This crop is grown on a scale of 2,000 acres and is frequently grown on the same land year after year. The serious "Wilt" disease (*Rhizoctonia Solani Kuhn*), is, however, widely distributed and it seems essential to find a second cash making crop for this neighbourhood. Experiments with cotton indicate that this crop is peculiarly suitable provided the wrong variety is not selected. Triumph American cotton has for instance proved quite unsuitable but in the year under report excellent results were obtained with the varieties tabulated in the following statement on land which has grown potatoes for some years; in this connection it is to be remembered that the soil is very porous and hence a great deal of the manure applied to the potato crops must have been washed deeply down into the sub-soil where tap-rooted crops may be expected to recover much of it;—

Area in acres sown.	Name of variety.	Yield of seed-cotton in lbs. per acre.	Remarks.
0·5	Sindhi ...	1,510	No manure was applied to the cotton.
0·5	Cambodia ...	1,172	
1·0	Goghári ...	1,017	

In the year under report deshi cotton could easily be sold at Mirpurkhás for Rs. 10 per (80 lbs.) maund but even if we value the Landhi produce at Rs. 8 per maund the value of the produce per acre exceeds Rs. 150 per acre. It is necessary to point out that the season was a very wet one which favoured the cotton but if it does equally well in a normal year then it seems certain to have a future in the Landhi-Malir tract.

21. At Sukkur it has been found that rice and berseem constitute an excellent rotation, as these crops appear to mutually benefit one another—this is a significant result in view of the probable establishment of rabi irrigation in the rice tracts of Lárkána and elsewhere.

IMPLEMENTS.

22. On the Jamrao Canal, where much of the land is stiff-working the scope for some of the more common tillage implements, designed for working such soils in Europe, is obvious. As an example of this, a heavy Cambridge Clod-crusher, which at first sight might be expected to frighten the Jamrao cultivators in view of the quality of his draft bullocks, has on the contrary created an excellent impression by the quality of its work; it breaks down stiff soils so efficiently that it has appealed to the people and the problem of draft has not proved difficult to surmount, as two pairs of cattle have been yoked. This implement cost between Rs. 200 and Rs. 300 before the war and hence there will not be a rapid sale in the early future, but if a system of hiring be introduced then it seems probable that such implements will be in great demand.

23. In another direction, however, it is possible to point to considerable progress in spite of the war. This has been the success met with in the demonstration of light iron ploughs. Two types were selected for demonstration—the Monsoon and the Rajah—and in this, the first season, a total of 95 ploughs (20 Monsoon and 75 Rajah) were sold on the Jamrao in spite of the prices having risen to Rs. 28 and Rs. 38 respectively. The Rajah though dearer is the better plough, being better balanced and much steadier in the stiffer soils. The Punjabi Colonists were not altogether unfamiliar with this plough which has proved a great success in the Punjab. Special arrangements have been made with the Collectors of Thar Párkar and Nawábshah to grant takávi loans to zamindárs who require them, to purchase these ploughs. No cash changes hands but the applicant for a loan receives a *chit* from the disbursing officer, which can be exchanged at one of the Agricultural Department's centres for a plough. A skilful man can drive and control a Rajah plough single-handed but few Sindhis are willing to attempt this and hence two men are required. Recently an offer was made of an increase in pay of 4 annas per day to any man on the Mirpurkhás Farm who could manage a Rajah plough but no one was willing to take advantage of the offer.

24. The Canadian Spiked-tooth-lever Harrow has been introduced in the year under report and has proved useful for harrowing standing cereal crops. Of the Presidency implements

introduced, the Jalgaon wheat seed drill did good work on the Mirpurkhás Farms where over 50 acres of wheat were sown with it. The inter-culturing blade-hoes have done fair work on cotton at Mirpurkhás and very good work on lucerne, cotton and other crops at Landhi, while the Mánjri Spiked hoe has also done good work on cotton and sugarcane. The Dhárwár Conical Stone Roller was found efficient at Lárkána where two bullocks with its aid threshed out in 5 hours as much grain as two pairs of oxen, by treading alone, could thresh in 8 hours.

Cultural Operations.

25. There is great scope in Sind for improving the methods of cultivation. To begin with, the land is rarely adequately ploughed. During the year under report special attention has been given to the preparatory operations in wheat cultivation at Mirpurkhás. The best practice in the Presidency is to till wheat land at short intervals throughout the monsoon. Thus in Broach District, where the blade-harrow is a very suitable implement for the class of soil to be dealt with, the land may be harrowed as often as 15 times. By this practice weathering operations are greatly facilitated and a good amount of available plant food becomes stocked in the soil while the sub-soil becomes thoroughly aerated and receptive to the wheat roots. Thus in the case of plot IX-3 on the Seed Farm the land was ploughed four times as noted in the margin. After each ploughing the land was sammared with the plank or rolled with the Cambridge Clod-crusher while the blade harrow was also used as found necessary. Pissi wheat was drilled on the 4th November with the Jalgaon three-coultered drill and although the standing crop received only one watering a yield of 23⅝ (1,894 lbs.) maunds of grain per acre was reaped, while from the adjoining plot which received similar treatment, but no irrigation at all to the standing crop, an outturn of over 19 maunds (1,533 lbs.) per acre was secured. This was from a stiffish-working soil which under local methods would have required at least 3 or 4 waterings to the standing crop.

Ploughed with Egyptian plough	..	30th July.
Ploughed with Monsoon	„	..14th August.
Ploughed with Sabul	„	..4th October.
Ploughed with Rajah	„	..22nd October.

26. Another great defect in local practice is sowing all crops broad-cast instead of in lines. This results in the excessive growth of weeds which cannot be removed by bullock hoes and hence the crop either becomes submerged or a heavy expense on hand-weeding has to be incurred. Experiments have shown that with a little skill crops like cotton can be sown on this land by bullocks in lines and the Department is now concentrating special attention on the demonstration of this method.

27. Where the crop has been sown in lines the hard crust which forms after irrigation can be broken up with a plough or hoe, and a large percentage of the weed growth destroyed. This practice has been also introduced on the Government Farms and is being demonstrated in the district. In the case of cereal crops the crust after irrigation can very effectively be broken up by the Canadian Spiked-tooth harrow which does not damage the crop in the early stages. This implement has been used with good effect upon wheat and bájri at Mirpurkhás but where the land is of a very stiff nature then a heavier type of the same machine is required.

28. At Lándhi where large areas of lucerne are cultivated in the Malir tract the superiority of the method of sowing on ridges 2 feet apart over the local system of sowing in beds which become choked with hariali grass, has been very effectively demonstrated and in the light soil of that farm the inter-cultivating hoes work with great efficiency and keep the crop very clean and the surface well mulched.

29. Another operation successfully demonstrated at Landhi is with regard to the application of manure to potato land; the local practice is to spread it on the surface and then till the soil, but much of the manure can still be seen tossing about in dry lumps on the surface when the crop is harvested; the system demonstrated is to spread the manure in furrows which are then spilt so that the furrows become ridges in which the potato "sets" are subsequently planted with the manure immediately below them.

30. At Sukkur the various improvements in the cultivation of sugarcane worked out on the Mánjri Farm, such as are noted in the margin, have been adopted.

1. Selecting "sets" from tops.
2. Planting "sets" in double-rows at intervals of 3 or 4 feet instead of in single rows close together to facilitate after-tillage.
3. Planting sets in such a way that the buds are on the sides of the sets after planting and not above and below.
4. Earthing up with a Sabul plough.

Irrigation.

31. The economy of irrigation has received special attention at Mirpurkhás. By adopting the tillage methods described in paragraph 25 above excellent crops of wheat were raised on

the Seed Farm with only one irrigation and in some cases without irrigation to the standing crop. The results obtained are summarized in the following statement :—

Name of wheat.	Area in acres.	Yield of grain in lbs. per acre.		Series.	Plot.	Remarks.
		One watering.	No watering.			
Pusa 12	The comparisons were made on half plots, measuring from 1 to 1½ acres per whole plot.	1,333	1,172	8	3	Soil somewhat stiff.
Pissi		2,048	1,533	9	2	
Pusa 12		1,116	970	13	1	Light free working soil.
Pusa 12		1,600	1,680	13	2	
Pusa 12		1,418	2,062	13	3	
Pusa 12		1,718	1,633	13	4	
Pusa 12		1,067	1,333	13	5	

32. Growing wheat without irrigation is a well-known practice in many parts of Sind where it is known as bosi cultivation but not on the Jamrao which in the opinion of the zamindárs is not a bosi tract. Under the circumstances the results noted above are of much interest and importance. The conclusion, however, should not be drawn that the bosi system should be introduced upon the Jamrao. This system is only possible where the texture of the soil is suitable but good tillage does neutralize to a great extent the unsuitability of stiff-working soils for this system of cultivation. On the whole it may be provisionally concluded that maxima outturns of wheat should be possible on the Jamrao with not more than two irrigations judiciously given during the period of growth, provided the preliminary tillage is good. Similarly, observation points to three irrigations to the standing crop as suitable for a full crop of bájri.

District Work.

33. The staff allotted to this work now stands at :—

1 Divisional Superintendent of Agriculture.
5 Graduate District Agricultural Overseers.
1 Non-graduate District Agricultural Overseer.

Mirpurkhás on 12th and 13th January 1917.
Nawábshah on 25th and 26th January 1917.
Tatta on 31st January 1917.
Lárkána on 15th February 1917.

Four shows were held in the course of the cold weather as noted in the margin. These have been separately reported upon and call for no remarks here.

The routine district work has proceeded on much the same lines as hitherto but important additions have been made to the stock-in-trade of the District Agricultural Overseers. On the Jamrao, demonstrating the light iron plough has been a prominent feature in the year's work and this has also been demonstrated in other parts of Sind on a smaller scale. The other implements mentioned in paragraph 24 above have been demonstrated. Attention is now being concentrated on sowing cotton in lines and subsequent inter-cultivation. Seed distribution has been conducted on only a limited scale as there is not yet enough selected deshi cotton seed available, while in the case of wheat preliminary investigation is not quite complete yet. The demonstrations of grafting and budding at agricultural shows have awakened some interest. A zamindár who visited the Tatta show recently indented for 300 fruit trees. The District staff are being encouraged to make and record agricultural observations and to write notes after conducting special enquiries into various practices, such as fruit cultivation at Tharushah. The Divisional Superintendent of Agriculture had sub-stations at the marginally noted centres where he demonstrated N. R. cotton, Pusa 12 and other wheats, Nigerian bájri, certain new crops like groundnuts, together with the improved implements and cultural methods referred to in preceding paragraphs.

Jamesabad.
Matli.
Nawábshah.
Shikárpur.

Live-stock.

34. During the course of the year Government have decided to open a stock farm for "Karáchi" cattle near Karáchi, to be called the Willingdon Cattle Farm. The stock reported upon in last year's report will be transferred to that farm together with their offspring. These now number 8 in all, each of the cows having in the course of the year produced a calf. In addition, the Superintendent, Civil Veterinary Department, has purchased 8 yearling heifers and 4 yearling bulls so that the strength of the herd has now reached 20 head. The milk records of the year under report were not quite so good as last year, but owing to the closure of irrigation between the 19th February and the 1st June there was a shortage of green fodder in the hot weather months and one cow had mammitis at calving time. The young cattle purchased in the course of the year suffered from foot-and-mouth disease which was not severe but proved very persistent and difficult to root out. The offspring of the cows will require selection, as one has unfortunately a roan colour, but among the others there is one very fine bull calf.

EDUCATION.

In August 1916 the fourth session of this school was completed, when 8 out of the nine students taking the course satisfied the examiners. Practical Agriculture was made a special feature of the examination, and all candidates were required to plough a piece of land as well as to adjust the ploughs. This was the first session in which practical work was made the main feature of the instruction, and the boys after they got over their first objections responded very well to what they were called upon to do. Out of these boys 3 are engaged on their own lands while one has secured a small grant of land on the Jamrao.

The fifth session will soon be complete. There have been 10 boys on the roll-call during the year drawn from the marginally noted districts. Seven boys are Mahomedans and 3 Hindus; one of the former is the son of a Punjabi Colonist. These boys did not take readily to their practical work at first but subsequently they settled down and their vegetable area is very creditable, being an improvement on the work of their predecessors. Some of the boys have also learned to handle the Rajah plough with considerable skill and to make ridges for cotton sowing. The students were also given special instructions in fruit cultivation, being taught grafting and budding. On several occasions they were taken to the Veterinary Hospital where they were shown how to treat simple wounds and ailments and to the Seed Farm where they saw improved methods of agriculture being applied on a large scale.

Name of district.	Number of boys.
Thar Párkar ..	6
Hyderabad ..	1
Nawábshah ..	2
Lárkána ..	1

Mr. Ali Mahomed, a graduate of the Poona Agricultural College, who has had experience both on the farms and in the district, assumed the duties of Head Master.

The cost of the school under all heads amounted to Rs. 2,597 against Rs. 3,441 last year, the difference being accounted for by no capital expenditure in the year under report.

T. F. MAIN,
Deputy Director of Agriculture, Sind.

APPENDIX F.

WORK DONE UNDER THE DEPUTY DIRECTOR OF AGRICULTURE, KONKAN, 1916-17.

The work of the Agricultural Department in the Konkan Division during the year 1916-17 fell, as in former years, into two principal categories, viz., Experimental work including investigating into new possibilities and Extension work. The former was mainly conducted at the two Agricultural Stations—Alibág and Ratnágiri—the centres representing the North and the South Konkan respectively. Some simple tests were also carried out or results of the experimental work at the Agricultural Stations verified on cultivators' fields under the immediate direction and supervision of the District Staff. The extension work which consists of dissemination and introduction of proved improvements amongst the agriculturists, making arrangements to supply improved implements, manure and seed or other appliances and itinerant advice is chiefly carried out by the District Staff; in some localities, the Agricultural Associations have co-operated with the Department in this task.

2. The new features of the year's work are—

(i) The starting of the work at the Kumta Farm from January 1917. The land has been leased and levelling and laying out into plots commenced.

(ii) The opening of the Agricultural School at Jambul, Táluka, Kalyán, District Thána. The 1st session has commenced from 1st of June 1917.

(iii) Opening of a separate entomological section for Konkan with a whole-time Entomological Assistant.

(iv) Division of the district work of Thána into two charges—North and South—with an additional Graduate Overseer. This division had, however, to be subsequently suspended owing to the withdrawal of the additional graduate for work in another division.

EXPERIMENTAL WORK.

3. *Disturbing influences of the year.*—The character of the season which greatly influences the cultivation part of the experimental work was far from favourable. The heavy and continuous rainfall late in the season lodged down crops which were almost ready. The matured grain dropped down in the water and the straw became dirty and decomposed, being steeped in water. The *varkas* crops of *nágli* and groundnut also suffered. The effects were particularly felt in the Ratnágiri District where the crop is earlier than in North Konkan and the falls were heavier.

The rice stem-borer was very rampant during the year on the Ratnágiri Farm.

The following comparative figures of the average outturns per acre of the main crop of rice, calculated from the whole area under cultivation on the two farms for the last two years, gives an idea as to the state of affairs :—

Farm.	Average outturn per acre of paddy.	
	1915-16.	1916-17.
	lbs.	lbs.
Alibág Farm ...	2,462	1,982
Ratnágiri Farm :—		
Upland ..	2,032	900
Lowland ..	2,360	1,148

Rice.

4. Owing to the peculiar climatic conditions of the Konkan, rice has necessarily been the principal food-crop of the low-lying areas and occupies, on an average, 68 per cent. of the total cultivated area. It is legitimate therefore that most of the experimental work should be concentrated on the improvement of this crop. The work during the year was mostly a continuation on the lines adopted in previous years, and has yielded results which are summarized under each head.

I.—Manurial Experiments.

5. *Seed-bed manuring—Ráb and Ráb substitutes :*—The results of the year both on the Alibág and Ratnágiri Farms confirm the conclusions arrived at in the last report that—

(*a*) rábbing is very effective in producing vigorous seedlings ;

(*b*) equally good or even better seedlings can be grown with substitutes like oil-cake, fish manure, or ammonium sulphate at no more cost, if the labour required for collecting *ráb* materials is valued ;

(*c*) and therefore wherever *ráb* materials are insufficient it would be profitable to use all the available *ráb* material on only so much area of the seed-bed as it will suffice to produce optimum results and use substitutes on the rest;

(*d*) the attempt to economise *ráb* materials by burning the soil in heaps with one-quarter *ráb* material has not been successful;

(*e*) the burning of the seed-beds earlier (in April) is better than later.

6. *Field manuring.*—Green manuring, bulky, concentrated and indirect manures were tried.

7. *Green manuring.*—On the Alibág Farm the addition of green matter in the form of green manure crops of *san* and *dhaincha* has shown a benefit; but on the Ratnágiri Farm, contrary to last year's results, there has been no gain due to the same except in one instance of *dhaincha* where the advantage amounts to 26 per cent.

The year's experience confirms the remarks made last year about the impracticability of obtaining any appreciable growth from these two plants under the climatic conditions obtaining in Konkan in the short period of about 15 to 20 days available between the commencement of the monsoon and the time of ploughing the fields preparatory to transplantation and that the only possibility of getting sufficient growth is by giving the crops a two or three weeks' start before the monsoon with irrigation wherever such facilities exist.

Green manuring with *san* for the *vaingan* rice tried on a cultivator's field at Pochri, Táluka Sangameshvar, District Ratnágiri, has, as in the previous year, proved convincingly profitable.

8. Other sources of obtaining green matter are from permanent trees and shrubs. In Madras this source is the common practice. On the Alibág Farm green leaves of *karanj* are being tried for the last two years.

Karanj leaves in addition to affording a quickly decayable organic matter is very rich in nitrogen, a 62·50 per cent. moisture containing stuff possessing 1·09 of nitrogen. Four thousand pounds of green leaves per acre incorporated into the soil at the time of puddling is responsible for an increase of 15 per cent. which is worth Rs. 12 according to the outturns obtained this year. There are many *karanj* trees in the North Konkan and more could be planted along the boundaries of farm steads or on *varkas* lands.

9. *Bulky manures.*—Rice hulls, urine earth and night soil in a heavy dose are under trial at both the farms—Ratnágiri and Alibág; the Ratnágiri Farm had in addition a light dose of night soil and cattle folding, and Alibág Farm *mowra* refuse (residual effect) and poudrette in the series. All the manurial treatments have brought about substantial increases in the outturn on both the farms, varying from 20 to 30 per cent. The residual effect of *mowra* refuse on the Alibág Farm is remarkable; the results of urine earth substantiate previous observation that while on the laterite soils of Ratnágiri it is beneficial, on the trap soils of Alibág it continues to act deleteriously.

10. *Concentrated manures.*—The use of oil-cakes (*karanj* at Alibág and *undi* and groundnut at Ratnágiri), fish manure and ammonium sulphate, bone-meal and superphosphate (only on the Alibág Farm) was continued. All the nitrogenous manures, applied at the rate to supply 20 lbs. nitrogen per acre, have consistently with the previous year's results enhanced the outturns by about 15 per cent. in the richer trap soils on the Alibág Farm and from 20 to 60 per cent. on the laterite soils of the Ratnágiri Farm. The effects of the manures on the poorer soils are more marked, *undi* cake on the uplands of the Ratnágiri Farm, for instance, having brought about a net profit of Rs. 32 per acre. Increasing the quantity to 30 and 40 lbs. of nitrogen per acre has not on the whole, as noted in the previous year, increased the net profits.

In the case of bone-meal this year's results on both the farms generally lead to the same deduction as that of the last year, that though 400 lbs. of bone-meal per acre increased the outturn by 18 per cent. on the Alibág Farm and by over 50 per cent. on the Ratnágiri Farm, the cost of bone-meal of Rs. 7 per cwt. cannot, however, leave a profit. A lesser quantity will be tried in future. Mineral superphosphate on the Alibág Farm has shown up better than in previous years, though not yet to the extent of leaving a net profit.

When mineral superphosphate is combined with green leaves of *karanj*, or ammonium sulphate, it has given additional benefit equal to its own, tested singly. *Karanj* leaves added to bone-meal have not brought about an additional increase.

11. *Indirect manures.*—Common salt at the rate of 800 lbs. per acre increased the outturn by 82 per cent. on the uplands and 36 per cent. in the lowlands on the Ratnágiri Farm, the net profit after deducting the cost of manure amounting to Rs. 17 and 8 respectively. On the Alibág Farm the increase has been 15 per cent. in one case but none in the duplicate. In the Ankola Táluka of the Kárwár District 500 lbs. of salt increased the outturn by 30 per cent.

Lime on the Ratnágiri Farm has effected an increase amounting to 36 per cent.

II.—Cultural Experiments.

12. *Preparatory tillage.*—Ploughing or deep hand-digging of the rice land in the hot weather on the trap clay soil of the Alibág Farm has, as in previous years, failed to show any

benefit; breaking up the soil in hot weather is, however, a regular practice in the salt rice lands reclaimed from saline creeks in North Konkan as well as in sandy rice lands of North Kánara District generally.

13. *Number of seedlings in a bunch and spacing in transplanting.*—Four special seedlings transplanted at 9″ × 9″ as in previous years have proved superior to 16 or 12 ordinary seedlings planted at 12″ or 9″ apart, as in local practices at Alibág and Ratnágiri respectively. The question whether this advantage is due to additional *ráb* burnt on the seed-bed, thinner seed rate, lesser number in a bunch, closer distance in transplanting, or a combination of two or more factors of these is still under investigation.

Reducing the number of seedlings of the same quality, keeping the distance constant has not been able, on the Alibág Farm, to keep up the yield as with the ordinary practice.

Similarly, on both the farms, reducing the distance of transplanting from 9″ × 9″ to 6″ × 6″ which was only tried with four special seedlings has not given an advantage.

14. *Transplanting, broadcast or drill sowing compared.*—As regards a comparison of sowing sprouted seed (*ráhu*) in a puddle with transplantation on the uplands of the Ratnágiri Farm, the year's results when viewed with those of the previous year indicate that *ráhu* sowing is a better practice than transplantation on such lands. *Ráhu* sowing was also tried in low-lying fields on the same farm but the crop compared very poorly with the transplanted one.

In the low-lying fields, on the Ratnágiri Farm, again, drill sowing was compared with transplantation, and the results point to the same conclusion as last year that the seedlings in the sown plot make a poor growth, the soil gets infested with weeds and packed by the heavy showers, the operations of weeding and stirring the soil cost as much as *rab* and transplanting and the ultimate outturn is also much less. Similar was the result in an experiment carried on a cultivator's field at Honávar on uplands.

III.—Improvement of Seed.

15. *Grading and mass selection.*—Grading of paddy seed by the salt water method has, contrary to previous year's results, shown a slight advantage of about 5 per cent. The improvement caused by the selection of big and well developed ears has been maintained at 13 per cent. consistently with previous year. This is a conclusive result.

IV.—Varietal Experiments.

16. At Alibág, *halva* amongst the early and *kolamba* amongst the late have maintained their first position as was also noticed in the previous year. At Ratnágiri the results have been extremely irregular owing to lodging caused by late rains and borer attack; *bhadas* would, however, seem to have withstood all the adverse conditions better than any other, so as to stand, as in the previous year, the foremost in yield amongst the late varieties; amongst the early ones, the local *halvi patni* has taken the first position; *shinicri*, a variety from America, is promising.

In the Kánara District some varieties were tried on cultivators' fields in the absence of any farm. Deep water paddy from Assam for fields liable to be flooded by river did fairly but did not yield as much as the local. *Maskáti*, an early variety for uplands, imported from South Kánara, was found satisfactory; *raskadum* though fine and scented and early ripening yielded poorly.

BANDH CROPS.

17. The bunds of the low-lying fields in the Ratnágiri District are not in a suitable condition to grow any crops during the monsoon, the roots of crops very soon reaching the oversaturated sub-soil, as the bunds are not more than 9″ high and about equally wide. On the bunds of the uplands, however, early crops like *udid, chavali, bhendi, nágli, vari*, thrive well, and are worth extending in other parts of the district.

On the Alibág Farm guinea grass was tried in addition to *mendhal* (*Dolichas spp.*) and *tur*. It established itself well and gave two cuttings; it checked the growth of other weeds and kept its vitality throughout the hot weather.

Rabi Crops in the Rice Fields after the Harvest of Rice.

18. *New crops.*—Several crops from upcountry were tried in the low-lying fields of the Ratnágiri Farm; groundnut alone succeeded in addition to those that are already being grown; to others the moisture was found too much.

Wheat is being grown as a *rabi* dry crop in the northernmost end of the Thána District. It was tried at Thána in rice fields as a dry and irrigated crop; it gave good promise of success. In the North Konkan there is a class of lands called *rabi* which are not favourably situated for rice cultivation and are devoted exclusively to grow *rabi* dry crops. On the Alibág Farm on such lands *shalu* (*rabi*) *jowár* from the Deccan was tried for the first time and has given very promising results.

19. *Drilling of rabi crops.*—Throughout the Konkan, *rabi* crops are all sown broadcast and mixed in the soil with a plough. On the Ratnágiri Farm *kulith* was sown by a drill to see

whether drilling would not be a better practice. The drilled plot yielded at the rate of 1,400 lbs. per acre as against 1,100 lbs. in the broadcasted plot.

Irrigated Crops.

20. Irrigation facilities, wherever they exist in Konkan, are not properly resourced except for cocoanut and betelnut palms in the coastal belt, and for vegetables and market gardening round about Bombay. In the Ratnágiri and Kánara Districts there are many localities even inland where stream or well water could be made available. This water is often wastefully used only for *vaingan* rice or irrigated *nágli*. In the inland of the North Konkan such facilities though few are not turned to advantage at all. With a view to find out remunerative crops suitable for Konkan, experiments have been in progress both at Alibág and Ratnágiri Farms.

21. *Onion.*—There is no doubt left about the suitability of this crop for general adoption in Konkan. It is only a matter of repeating the crop for demonstration in as many centres as possible before it becomes a common crop of cultivation; wherever irrigation facilities are available.

Manurial experiments at Alibág thoroughly establish the value of poudrette, the most profitable combination being 15 carts of poudrette with 800 lbs. of fish manure.

22. *Chillies.*—On the Ratnágiri Farm an outturn of 1,200 lbs. of dry chillies was obtained. This is another crop worth being generally adopted in Konkan.

Sulphate of potash at the rate of 1 cwt. per acre increased the outturn of chillies by 500 lbs. of dry chillies per acre valued at about Rs. 80, as was also the case last year.

23. *Sugarcane.*—This year, on the Ratnágiri Farm, where only work with this crop is going on, Red Mauritius variety of cane has stood superior to local *Devgadi*, as in last year, and has yielded an outturn of 12,000 lbs. of *gul* per acre which compares close to the maximum obtained in the Deccan. Striped Mauritius, which was tried for its earliness, turned out to be full two months earlier than the Red Mautitius, the yield not being comparable as the germination was irregular, owing to the sets receiving injury in transport. This last variety was also tried at several places in the four districts on cultivators' fields on a small scale, where it was also reported to be an early and promising variety except from Honávar in the Kánara District where all the sets failed to germinate owing to long transport.

In the Kánara District also the Red Mauritius has maintained its superiority and is supplanting the local *Daskabbu*.

24. *Potatoes.*—Again failed.

25. *Other vegetables.*—Almost all other vegetables succeed except peas.

26. *Sugarbeet* was given a trial on the Ratnágiri Farm and places in the district. They grew well. The trial will be repeated and sugar content determined in future trials.

Development of Varkas Land.

27. *Varkas* land is the next important section of Konkan agriculture after rice and especially assumes greater importance in the Ratnágiri District. At present the cultivation of these lands is in the hands of the most ignorant, unenterprising and poorest tenants, who grow some annual hill millets which only provide them some food in return for the labour they have to put in. There are immense possibilities to develop such lands if better intelligence and capital is diverted to this section of Konkan agriculture. The work under this section was carried on at only one centre, viz., Bandhan Sub-station attached to the Alibág Farm.

Embanking and terracing.—The advantage of this line of improvement will only be visible after some period. The plan is to crop the terraced fields continuously instead of periodically.

28. *Improvement in the existing crops—Nágli.*—Green manuring with *san*, has, as in previous years, increased the outturn this year, the grain amounting to 480 lbs. or 200 per cent. and leaving a profit of Rs. 6 per acre after allowing for the cost of green manure (Rs. 10). Transplanting *nágli* in furrows made by a plough has resulted into an increase of 248 lbs. or 31 per cent., over the ordinary method of transplanting broadcast.

Four kinds of rotations either with existing or introduced crops are being tried. Results can be available after some years.

Tree plantation.—A portion has been reserved for *rab* materials. Mango, cashewnut, and jack, under fruit trees, and bamboos, myrobolams, *karanj*, *jambul*, *undi*, agave, and tamarind, under other economic plants, were put in during the year.

29. *Introduction of more remunerative annual crops.*—Groundnut has already proved its worth; the only difficulty to its being generally adopted is the trouble from depradatory animals like pigs and jackals, crows, etc. The big late varieties are again found to be more profitable than the early small ones. For small varieties $12'' \times 9''$ is the best distance to plant. Late sowing (in July) of groundnut gave much less outturn than that sown at the beginning of the monsoon.

The new crops that were tried in addition were *sorgham jowár*, san for fibre, tobacco, hill paddy, sweet potatoes, turmeric, chillies, *tur*, and sesamum. The following were successful yielding outturns as mentioned against each :—

Name.	Outturn per acre.	Value.
	lbs.	Rs. a. p.
Hill paddy (*sarwat* from Ratnágiri) ..	2,160	67 8 0
Sweet potatoes ..	11,200	350 0 0
Turmeric ..	300	20 0 0
Chillies { Green ..	1,446	143 13 5
Chillies { Dry ..	140	
Sesamum ..	222	17 12 5
Sorgham jowár ..	4,580	45 0 0
Nágli (for comparison) ..	741	24 11 2

Improvement of Fodder Supply.

30. *Introducing better varieties of grasses.*—*Marvel* and guinea grass continued to be the best of the grasses tried on the Ratnágiri Farm ; the second when tried on the Varkas Sub-station of Alibág has also well established.

31. *Ensilage.*—This was done out of green grass both on Ratnágiri and Alibág Farms with as good a success as could be expected in *katcha* pits.

32. *Cultivated fodder crops.*—Lucerne, berseem, maize, *imphee jowár*, velvet bean were tried on the Ratnágiri Farm. Lucerne was only fair this year, yielding only 11,000 lbs. per acre in four cuttings as against 37,000 lbs. in seven cuttings of last year. A feeding experiment was carried on on a milch buffalo for 6 weeks. A daily ration of 10 lbs. was given every day. Feeding of lucerne caused an average increase of 1·25 lbs. per day which was just enough to pay the cost of lucerne.

An experiment in fodder raising was also tried in connection with the Thána Co-operative Dairy. Maize, *jowár*, *vál* and carrots were tried under irrigation and with 50 cart-loads of farm-yard manure. The outturns which varied from 15,000 to 33,000 lbs. per acre of green fodder are very encouraging ; maize and *vál* mixture yielded the highest. If the area is permanently fenced so as to exclude stray cattle, fodder raising promises to be a profitable adjunct to a dairy in Konkan.

Garden Cultivation.

33. This is the next important section of Konkan agriculture which is mostly restricted to the coastal belt and to the up-ghát portion of the Kánara District, where good irrigation facilities exist. The most important crops are cocoanut and betelnut, and plantains, betel-vines, ginger, *chickus*, etc., in the West Thána where transport facilities and a good market of Bombay are available. Mango is another most important semi-garden crop that requires attention.

It has not yet been possible to provide for any systematic experimental work in this section, and advice was given on the basis of the results of experiments and experience obtained elsewhere.

Trial of New and Improved Agricultural Implements, Machinery and Appliances.

34. *An improved plough of Konkan.*—Meston plough cannot suit all soil conditions obtaining in Konkan. A new plough has been planned and is being worked out.

Acme harrow.—In addition to being useful for making a puddle, it has been found useful for mixing the seed in the seed-bed.

Chatanooga No. 12 sugarcane mill and Balsar rahat (a modified noria) continued to work satisfactorily.

Special Problems under Investigations.

35. *Manat land reclamation.*—In the Kolába District there is a considerable proportion of flat low-land along the sea and creeks and also in the interior which has a very clayey and sticky consistency and does not produce any remunerative crops. A plot of such land has been taken up near Alibág to investigate the methods of improving them. Deep tillage, drainage, and improving the texture by the addition of green matter in the form of green manure crops, or coarse dry matter such as dried leaves, rice husk, or by liming or burning of the soil, are being tried. Deep tillage is already showing up a slight advantage. It has not yet been possible to get a good growth of green manure crops. No appreciable effect is yet observed from the other treatments except burning which has proved beneficial.

A commencement was made to test the adaptability of several crops to the existing conditions; sugarcane by Java method was tested; it gives some promise of success.

36. *Gul making from palms.*—Mr. Sorabji B. Patel of Tadgaon, Peta Umbargaon, District Thána, repeated his experiment with wild date palm with better success than last year. The writer of this report was deputed to Bengal to study the methods there, where he found the methods followed are more systematic and organized and more effective in drawing unfermented juice required for *gul* making. Improvements made by Mr. Annett in those methods were also studied. Next year a systematic departmental experiment with the help of Bengal tappers and with the knowledge gained is contemplated.

Some cocoanut tappers in the Bhatkal Peta of the Kánara District were granted permission to manufacture *gul* from cocoanut toddy. One man can manage 15 to 20 trees and can make *gul* worth Rs. 75 to 80 per year.

The condition of keeping detailed account of the output imposed in issuing the license has greatly arrested the concession being availed of on an extended scale.

37. *Band disease of betelnuts.*—Experimental work in diagnosing the cause of the disease has been taken in hand at Kelshi, Táluka Dápoli, District Ratnágiri.

38. *Utilization of fish refuse for manure.*—Preliminary work in estimating the kind and quantity of refuse, the time of obtaining and method of preservation was done.

39. Other matters, such as study of the nature of stagnated water in the rice fields, saline incrustations in the lands reclaimed from the creeks, degree of salinity of creek water on which certain crops can be grown, packing and transport and preserving of fruit and many others of minor and local importance, have engaged attention.

EXTENSION WORK.

40. This consists in introducing improvements into the actual practices of Agriculture, and giving such advice and help as will make the agricultural industry in general more profitable. This work has to be principally done by the itinerant district staff. For this purpose there is one graduate now available for each district; Thána had two for about 8 months. The following is the summary of the work done during the year in various directions :—

Agricultural Exhibitions.

41. No large exhibitions were held during the year, owing principally to the inability of the people to raise any funds for the purpose arising out of the strained financial conditions brought about by the war. A mango show and conference was contemplated at Ratnágiri but had to be abandoned owing to the failure of the crop.

Popularization and Introduction of Agricultural Improvements.

42. The Agricultural Stations serve as standing demonstration centres and were visited by many agriculturists. Special parties of cultivators from Thána and Kolába Districts were invited and shown the striking results of the Alibág Farm and the Bandhan Varkas Sub-station.

43. The chief and specially organized items of popularization and introduction in the district by the district staff are mentioned below :—

Groundnut.—In all four crop demonstrations were organized, one in the Shaháp ur Táluka in the Thána District and three in the Karjat and Roha Tálukas of the Kolába District, where this crop is not yet known. In the Ratnágiri District its advantages have been fairly universally known but there is a restriction to its cultivation on a very large scale owing to the damage done by wild pigs, jackals and crows. Special arrangements were made to supply seed, of which 893 lbs. in the Kolába, 400 in the Kánara, 380 lbs. in Ratnágiri were distributed.

Red Mauritius variety of sugarcane.—Kánara is the only district in Konkan where sugarcane is cultivated on a fairly large scale. The Red Mauritius variety has taken root wherever it was once given. This year 35,000 sets were distributed departmentally as against 25,000 last year. This represents an addition to the area under cultivation last year, as those that were supplied in previous year had their own seed; besides, some people got this seed from the neighbours without the intervention of the Department. Thus it is estimated that there might be about 100 acres under Red Mauritius in the Kánara District.

Onion.—Most work has been done in Kánara. The year's distribution amounted to Rs. 265 worth of seed which is four times as much as in the previous year. In the Kolába District at one and in the Ratnágiri District at four places, the crop was first grown for demonstration. In the Málvan and Vengurla Tálukas of the latter district there is already the cultivation of this crop.

Poona furnace and pans.—This has also the best scope for extension in Kánara where there is the most sugarcane area. Demonstrations were given at 14 places, at 3 out of which they extended over a sufficiently long period to impress the advantages on a working business scale. The work at these latter centres was thorough; the local people got themselves trained and it will not be necessary to go to these centres again. About 40 Poona pans are at work. The exhorbitant increase in prices has put a check to its rapid extension.

Chatanooga No. 12 sugarcane mill.—Even by a short demonstration this mill has been popular in the Kánara District. Four of these mills were sold and had it not been for the extraordinary rise in price they would have been sold in dozens.

Improved ploughs.—Meston plough was largely demonstrated in all the four districts as a general purpose plough. For the garden cultivation in the North Thána and for ploughing saline rice lands Sabul was demonstrated. In all 3 Sabul, 4 Madras and 20 Meston ploughs were sold.

Harrows, seed-drills and bullock hoes.—Utility and economy of these simple implements which are used in the *desh* to Konkan conditions of *varkas*, *rabi* and garden cultivation was brought to the notice of the cultivators of the North Thána. As a result 10 harrows, 3 drills, and 24 bullock hoes were supplied.

Denaturalized salt for manure.—This was advertised as largely as possible; permits were issued for the quantities mentioned below:—

Name of district.	No. of permits.	Quantity.
		Mds.
Thána ..	23	881½
Kolába ..	17	868
Ratnágiri ..	66	1,364½
Kánara ..	213	1,451

Poudrette manure.—The Thána Municipality has taken to manufacture poudrette. They turned out only 25 carts in the first instance and sold all at Re. 0-12-0 per cart. Other municipalities have been approached to do the same.

Pig-proof woven fence.—A small area has been enclosed with this fence at Killar, Táluka Siddápur, District Kánara, for trial and demonstration. It has proved effective in keeping the pigs out.

Supply of Implements, Manure, Seed and other articles to orders.

44. Besides the above, arrangements were also made to supply any kind of implement, manure, seed or any other article that was demanded by any applicant. These consisted of paddy varieties, cocoanut, mango seedlings, fodder and grain *jowárs*, vegetable seeds, *san* seed and artificial manures.

Dissemination of knowledge of Improved Methods in other ways.

45. Many articles and notes on local topics were published in the Agricultural College magazine, "Shetki and Shetkari," and local newspapers. The Agricultural Overseers were constantly touring and gave advice by short talks to groups of cultivators after personally examining the local conditions. Leaflets were freely distributed and many were induced to subscribe to "Shetki and Shetkari." Various enquiries were answered by my office, the two farms and the four Overseers by correspondence.

Concession and Aid to Agriculturists.

46. In the Kánara District it has been arranged to give free posts from the forests for wire fencing and to supply fuel for *gul* boiling at Re. 0-1-0 per guntha to those who will use the Poona furnace. A buffalo bull of pure Surti breed has been brought and maintained on the Alibág Farm, the service of which is allowed to the neighbouring agriculturists at Re. 0-8-0 for each buffalo served. The arrangement was fully availed of by the buffalo-owning cultivators and the maximum number of 50 was served during the year.

Agricultural Associations.

47. There are in all 10 Agricultural Associations—3 in the Thána District, 3 in the Kolába District and 1 District Association which has opened up branches at all the táluka places in the Ratnágiri district, and 3 in the Kánara District. The operations of the Honávar Táluka Association in the Kánara District were suspended as people did not seem to care for or take any interest in it, the ever energetic and enthusiastic Secretary Ráo Sáheb B. M. Basrúr continuing his usual activities as Honorary Agricultural Correspondent. No new associations were started during the year.

The Ratnágiri District Association is the only one which has commenced serious efforts in organizing practical work on systematic lines. A paid organizer has been appointed to stimulate and supervise the work through táluka branches.

The Sirsi Táluka (District Kánara) Association distributed 15,000 sets of Red Mauritius sugarcane from its demonstration plot and kept a set of sugarcane mill and Poona pans and labour saving implements for sugarcane cultivation on hire which were largely availed of. It possesses a demonstration plot which is financed by one of its members.

The Kumta (District Kánara) Association further popularized onion seed.

The Kolába District Association gave a contribution towards the expenses of the demonstrations to cultivators at the Alibág Agricultural Station and one of the Honorary Secretaries, Ráo Bahádur Kamat, very generously defrayed the boarding expenses of all the visitors.

Other associations are all defunct and have not responded to the efforts made by the members of the Agricultural Department to infuse enthusiasm and activity.

The Honorary Correspondent, Ráo Sáheb B. M. Basrúr, continued his activities in various directions in popularizing Meston plough, Red Mauritius variety of cane and Poona furnace, surgical castration, trying new manures for sugarcane and paddy varieties, and in developing his farm on the most modern lines, which is serving as a demonstration to others.

AGRICULTURAL EDUCATION.

48. Sardár P. K. Bivalkar's Primary Cum-Agricultural School at Veshvi (Alibág) continued to work with success.

49. The Agricultural School at Jámbul which was sanctioned last year commenced its working during the year under report, the buildings were completed and made available for occupation in May 1917, and the regular session commenced from 1st of June. In all, 13 boys are on the roll. They are Bráhmins and Maráthas by caste and are from Thána and Kolába Districts.

AGRICULTURAL SURVEY.

50. The various members of the staff during the course of their tours for extension work or with the special object of studying have continued to collect information on local conditions and practices, to find out defects and to investigate new possibilities. The information when complete is collated into notes and published, or forms the basis of future experimental and extension work.

V. G. GOKHALE,
Deputy Director of Agriculture,
Konkan Division.

APPENDIX G.

WORK DONE UNDER THE PROFESSOR OF AGRICULTURE, POONA, 1916-17.

I.—Introductory.

The Professor of Agriculture has supervisory charge of the Mánjri Sugarcane Station, the Agricultural College Dairy, and the College Farm in addition to his duties as Professor in charge of the teaching of agriculture, both practical and theoretical, at the College. Besides carrying on research work, these farms serve both for education and demonstration and are used as depôts for the distribution of agricultural supplies.

II.—Research Work.

Sugarcane.

The average outturn of the whole area of the farm planted with cane in 1916-17 was 34·4 tons of stripped cane as compared with 36·66 tons in the preceding year. The decrease is due to somewhat less favourable climatic conditions. The increased rates obtained for the *gul* have largely compensated us for this slight decrease so that the net profits are as high as, or higher than, in the previous year.

Mánjri method of planting.—The further trial of the new Mánjri method of planting sugarcane, five feet apart, has confirmed the results of the previous three years. We now feel that we can say with confidence that by this method as large an outturn can certainly be obtained as by any other. The great advantage of this system is that the labour and seed charges are substantially reduced, thus increasing the net profits. Incidentally it has been found that cultivators use about 25 per cent. less water when they cultivate their cane by this method and I have reason to believe that the manure requirements are also less; just how much less is under investigation. Considering only those savings already proved this new method enables the cultivators to effect an economy of $\frac{2}{3}$rd of his labour charges and one-half of the cost of sets.

Java method.—Further tests of this method have taught us that it is particularly adapted to the hard and thin varieties. With these varieties this method produces as large yields of both cane and *gul* as the Pundia under the local system of cane-growing. The most important point in the Java system is the great saving of water, since at no time it is as much used as by the Poona system and after the rains none at all is required. Less water has for its corollary less manure but the saving in this line is largely set off by the increased labour charges for opening the trenches. A modified system of deep planting in furrows opened by a heavy ridging plough is proving more useful.

These systems are eminently adapted to well irrigated tracts of deep heavy soil.

Manuring.—Nothing striking has resulted from these experiments this year but last year's results have been confirmed. We are now certain that green manuring with *san* when a good growth is secured, will produce as heavy a yield as the application of farm-yard manure, both being supplemented by an ample top dressing of some quickly available concentrate. Not only is an equal or superior crop obtained but the cost of the green manure is so much lower than the farm-yard manure that even if a crop of groundnuts is taken instead of the *san* and its profits credited to the farm-yard manure plot, still the balance will be in favour of the green manure. When land is taken on a yearly rental a modification of this practice is necessary by which the *san* can be grown the same season. This is already giving good results.

Stable manure continues to give exceedingly good results and is I estimate about twice as valuable as farm-yard manure.

The favourable results obtained with trash which contains only about one-fourth of the nitrogen of farm-yard manure emphasize the fact that the value of farm-yard manure lies very largely in the addition of organic matter to the soil and therefore that all possible sources of organic matter should be utilized by the cane planter. A considerable quantity of such material goes to waste as stubble, hulls, stalks, etc.

Both phosphoric acid and potash when used separately have increased the yield of *gul* and sugar and even at the present high prices of chemicals the increase also enhances the net profits. But when used together not only is the improvement secured when they are used separately lost but the yield is even decreased below that of the check. Just why this is so is to be studied.

Experiments to ascertain the minimum number of sets that are required by the new method lead us to believe that the reduction of half or more can be effected without affecting the outturn. This means a saving of Rs. 25 per acre.

The varieties of cane from outside that have been tried on a field scale have not yet shown an all-round superiority to Pundia but for special conditions some are promising. Five early varieties have been tried, among which Red Sports has nearly approached Pundia in outturn and ripened at 10 to 11 months. The classification of the Bombay varieties is progressing.

Cotton.

The year was not favourable for cotton at Poona. The germination was uneven owing to poor rainfall and the late rains caused three successive crops of bolls to drop. Still with all this our selected strain of white-flowered Khándesh yielded 888 lbs. of seed-cotton per acre. Selection work was very seriously handicapped by the peculiarities of the year and no advancement made.

Broach cotton did exceedingly well and gave an outturn of 1,184 lbs. per acre. When grown with a mixture the yield, as was to be expected in a dry year, was considerably lessened. The groundnut mixture affected this the least but although a crop of over 1,000 lbs. of nuts was obtained still the combined value is not sufficiently high to pay for the extra cost of cultivation. Groundnut would show up better in a year of better rainfall. In the previous year the mixture was more profitable than the cotton alone.

The separated seed gave us as in previous years a higher yield.

Jowár.

Bad though the year was for cotton it was still worse for *jowár*. In addition to scanty moisture conditions this had to face attacks of borers, aphids, army worms, sclerospora rust and striga. In only a few plots was any grain formed at all.

The newly imported grain sorghums produced grain and some of these may prove useful.

Wider planting and more thorough interculture of the *rabi* crop of *jowár* increased the yield by nearly 20 per cent. Separation of winter *jowár* seed increased the yield of grain by 40 per cent.

The selected strains are being continued.

Groundnut.

This crop also suffered from the shortage of rain. The small varieties at the College Farm yielding 1,200 lbs. and large kinds 2,000 lbs. or a little over one-half a normal crop. The new Big Erect yielded the latter figure. The manurial experiments were entirely vitiated by the conditions of the year.

Gram.

Kabuli variety has this year for the first time exceeded the local in yield, producing 2,000 lbs., and is valued 25 per cent. higher.

Chillies.

Applications of mixtures of chemical manures have produced as good yields as country manure but at greater cost.

Tobacco.

Chemicals applied according to Dr. Mann's mixture has increased the yield at a profit.

Bájri.

The most important work of the year with this crop has been the experiments in spacing and inter-tilling. An interval between rows of 15″ in such years as 1915-16 and 1916-17 has produced larger yields than the usual interval of 9″. But the full advantage of this wide spacing lies in the better opportunity for thorough inter-tillage in years of precarious rainfall.

III.—Education.

The change in the course which came into effect this year by which the three years' work is divided into a one year's course leading to the Intermediate Agricultural degree followed by a two years' course for B.Ag. necessitated some changes. The transfer of a large part of the buildings and some of the area also hindered the instruction work at the College. The practical work of the students was interrupted by the closure of the College on account of plague. But in spite of all these difficulties the results of the examinations in agriculture were on the whole quite satisfactory.

The Mánjri Sugarcane Class numbered 40 from all parts of the Presidency, consisting of men of all degrees, landlords as well as illiterate cultivators. The course was shortened to 15 days but the whole ground of sugarcane cultivation and *gul* preparation was effectively covered and the students went away satisfied that they had learned much of value to their practical work.

The distribution of implements, seeds and manures from the farms under my charge amounted in the last year to nearly 40,000 rupees. This includes ploughs, cultivation, *gul* making apparatus, etc. The workshops have been utilized to produce new patterns of implements. Many of these are still under experimentation.

The farms assisted by sending exhibits to the State Exhibitions of Baroda, Mysore, Junágadh and Jamkhindi. Dairy work and *gul* boiling and better implements were the principal lines shown.

The " Shetkari " was under the charge of the Assistants of this Department. Several leaflets were prepared by the staff.

The Dairy was carried on on the usual lines, no experimental work being attempted.

APPENDIX H.

REPORT OF THE AGRICULTURAL CHEMIST FOR THE YEAR 1916-17.

1. The office and laboratory of the Agricultural Chemist to the Government of Bombay has been under my charge for the whole of the year under report.

2. The routine analytical work of the laboratory was a little larger in amount than in the previous year. The following table gives the number of samples examined during the past three years :—

1914-15	..	1,560
1915-16	..	1,658
1916-17	..	1,813

3. The character of the analyses done is shown in the following list for the year under report, compared with those for the previous year :—

Nature of samples.	Numbers.	
	1915-16.	1916-17.
Soil ..	327	521
Manure ..	177	190
Feeding stuff ..	227	206
Water ..	488	641
Gul and sugar ..	8	*Nil*
Oilseeds and oil ..	88	32
Dairy products ..	36	64
Fruit ..	84	15
Strata of boring wells ..	121	*Nil*
Miscellaneous ..	102	144
	1,658	1,813

4. I have always maintained that the real test of the success of the laboratory in filling a public need is best shown by the use made of it by the public, both by actual cultivators and by those responsible for industries directly dependent on agriculture. The number of samples received for analyses from the public as distinguished from those from Government farms and departments continues large, and was as follows during the year under record, again compared with that for the previous year :—

Nature of samples.	Numbers.	
	1915-16.	1916-17.
Soil ..	148	147
Manure ..	101	119
Feeding stuff ..	103	29
Water ..	67	63
Gul and sugar ..	1	*Nil*
Oilseeds and oil ..	25	23
Dairy products ..	16	49
Miscellaneous ..	97	119
	558	549

5. The character of the work has differed little from that in the previous year, but there are a few special matters which have come up during the period which merit attention.

6. Perhaps the matter which most frequently came before me are questions concerning the saltness of water used in irrigation, and the development of salt in soil, thereby reducing the value of intensively cultivated land to a very considerable extent. The number of wells which are sunk, but which are afterwards all but useless owing to the water being unsatisfactory, is very large, and some striking samples have come before me during the year. This saltness in the trap area, even near the sea coast, is not by any means always due to ordinary common salt. I have very recently had a case before me where such water contained nearly 500 parts per 100,000 of salts, chiefly magnesium chloride, and such water is, of course, far more useless than even if it contained sodium chloride. Another type of water commonly found in the

Deccan appears at first sight very soft and suitable for use, but is found to contain sodium bicarbonate, and when this occurs, even in very small quantities without being balanced by larger amounts of calcium carbonate and of sodium sulphate and chloride, its effect on the condition of the black soil is ruinous, and it can hardly be used at all. I am often asked whether anything cannot be done to improve such waters. At present, such improvement seems almost impossible. The last class might be improved probably if large quantities of very cheap gypsum were available, but at present this does not seem to be the case.

7. During the year under report I went to the Konkan at the invitation of the Deputy Director in charge of that division to investigate a somewhat new problem in the development of salt in land, namely the appearance of salts of a distinctly acid character in the land. This seems, though I cannot yet speak with complete confidence, to be associated with the presence of a layer of soil full of vegetable organic matter which has afterwards been covered with silt to some depth and is then levelled and bunded for rice cultivation. Fermentation, chiefly anærobic, then goes on in the vegetable refuse, producing acid, which rises along with a certain amount of salt in these somewhat saline lands, during the dry season of the year. The remedy will undoubtedly be the treatment of such lands with lime and the very thorough cultivation and opening of the land each year after the rainy season is over. In connection with the evil effect of stagnant water in rice fields referred to in last year's report, work is still in progress, and I hope that considerable advances will be capable of report in the coming year.

8. The investigation of the whole question of the underground water supply in the trap area was continued during the present year, both by the accumulation of data as to the composition of such underground waters, and by continued work in detecting supplies by the water-finder. In the latter matter, the new water-finder referred to in my last report has been tested and found to be more sensitive than that previously in use. It is made by the "Schmid's Patent Automatic Water Finder and Engineering Co., of 64, Mark Lane, London, E. C., and has proved to give indications confirming my previous work on the subject.

9. Use has been made of my laboratory in connection with the agricultural application of sewage in two cases during the last year. In the case of the Poona City sewage, Professor Knight of the Agricultural College has been in charge of the work, and I have only done such analyses as he required. I was called in, however, by the Ahmedabad Municipality to decide as to whether the land of their sewage farm could be considered as "sewage-sick" and thus whether it would be necessary to purchase more land. I was able to show clearly that the land was not sewage-sick, that the appearances which had led to the supposition could be accounted for, and remedied otherwise, and that the very large expenditure supposed necessary to extend the farm was not at present needed.

10. In connection with soils and manures, I have examined during the year a number of samples of soil and water from Aden in connection with what it is hoped will be a considerable extension of vegetable and fruit growing there. I hope shortly to be able to publish two reports on the growing of vegetables and fruit there by Lieutenant D. S. Corlett, who is in charge of the matter, in which my analyses are incorporated.

11. Work on artificial manures consisting of experiments conducted on a large number of cultivators' fields, and done largely by my assistant Mr. S. R. Paranjpye under my control, has continued during the year and it appears more and more what a large field there is for their employment, at any rate at pre-war prices. A second bulletin on this subject is almost ready. We are making a special study as to the amount it will pay to use in connection with potatoes and are obtaining the very enthusiastic co-operation of the people in the potato villages in the north of the Poona District. Messrs. The Union Agency, Bombay, have very kindly subsidized this work to the extent of employing an agricultural graduate (Mr. S. D. Nagpurkar) to work under my supervision in connection with this and other work on potatoes.

12. During the year I have published a bulletin on which I have long been engaged on the "Fodder Crops of Western India," which has needed a considerable amount of laboratory work in getting the data together as to the composition of the fodders available in Western India. Judging from the reports so far received, this bulletin, which gives as complete an account of the fodder crops as I could make, has been found to be of considerable use by those who are engaged in feeding cattle for dairy and other purposes.

13. This leads me to note the fact that we have been engaged on preliminary study regarding the organization of additional milk supply to Poona City during the year which we hope will during the present year lead to a definite effort to see how far it is possible to organize an increase in the milk supply from distances which have not hitherto been tapped and from sources where the milk supply is very cheap. My assistant Mr. V. G. Patwardhan has been in charge of this work and has worked enthusiastically and well.

14. During the year a bulletin has been prepared and will be issued almost immediately by my assistant Mr. D. L. Sahasrabuddhe on the "Spice Gardens of Sirsi in Kanara" and their problems. This study which represents the first stage of what I hope will be an exhaustive inquiry into the many problems of this cultivation has been carried out with great capacity by Mr. Sahasrabuddhe, assisted by a group of students of the Poona Agricultural College. The

work is being vigorously continued as the problems are urgent, especially that of the very marked deterioration of the cardamom cultivation—the most characteristic feature of the spice gardens—in recent years.

15. My chemical staff have assisted me in the continued investigation of Deccan village conditions, which has involved much work both in the laboratory and in the field. The results of an intensive study of a single village is now in the press under the title "Land and Labour in a Deccan Village," and will be published by the University of Bombay. A similar study of another village in another part of the Deccan is now in progress, the chief field work being done by Messrs. D. L. Sahasrabuddhe and N. V. Kanitkar of my staff, with the help of some of the students of the Poona Agricultural College.

16. Some of the publications forecasted in previous reports have been delayed, but material for the following are in hand:—

(1) Second bulletin on Artificial Manures in Western India.

(2) Second bulletin on Underground Waters of Western India.

(3) Bulletin on the relationship of underground water to sub-soil material in the Kaira District.

(4) Paper on Safflower oil as a drying oil.

(5) Paper on the proteids of buffalo milk,

and several others are nearly completed.

17. I have just indicated a few of the special matters which have come before my laboratory during the year. Beyond these we have been called upon to examine materials and to advise in many matters. I have been in close touch with the development of the manufacture of magnesium chloride from bittern at Khárághoda,—with the revival of indigo growing in Khándesh, with the utilization of the solid portion of cotton seed oil as vegetable ghee, and with many other matters. Year by year the utilization of my laboratory seems to get wider,—and it seems more and more to serve what is realized to be a public need.

18. My staff has worked *very* well during the year. Mr. V. A. Tamhane, B.Sc., L.Ag., has remained senior laboratory assistant during the year, and has proved exceedingly capable and devoted to the work. He has been well seconded by Mr. D. M. Ranade, B.Sc., B.Ag., who is his second in command, and all the others have devoted their best attention and skill to the work of which they have been put in charge.

HAROLD H. MANN,

Agricultural Chemist to the Government of Bombay, Poona.

APPENDIX I.

WORK DONE UNDER THE ECONOMIC BOTANIST FOR THE YEAR 1916-17.

Enquiries.

The number of enquiries received on subjects connected with economic botany and horticulture has increased considerably. There is no doubt that the value of the department as an information bureau is being more and more realized by all kinds of people. The following list shows the enquiries received. Each number refers to a complete correspondence and not to single letters :—

Subject.	Number in 1916-17.	Subject.	Number in 1916-17.
		Brought over ..	473
Entomology ..	12	Plants and seed supply ..	103
Botanical advice ..	106	Plantains ..	11
Citrus ..	26	Personal ..	35
Disease ..	43	Rubber ..	..
Enquiries (Miscellaneous) ..	114	Sericulture ..	1
Arboriculture ..	14	Sugarcane ..	3
Fibres ..	1	Supply of specimens ..	9
Fodder ..	7	Seed testing ..	58
Grapes ..	12	Teaching ..	7
Horticulture ..	27	Weeds and grasses ..	10
Identification of plants ..	62	Wheat ..	2
Manures ..	12	Drug ..	9
Mangoes ..	37		
Carried over ..	473	Total ..	721

This is an increase of 107 over 1915-16.

Education.

The following pupils underwent special training at the Ganeshkhind Botanical Garden :—

Name.	Town or village.	Subject.	Period of training.
Mr. R. K. Apte ..	Poona ..	Brief course of practical Horticulture.	1st November 1916 to 7th December 1916.
„ D. B. Patwardhan ..	Poona ..	Do. ..	3rd November 1916 to 8th December 1916.
„ B. S. Tikekar ..	Alibág ..	Fruit culture ..	8th April 1917 to 12th May 1917.
„ S. V. Mandke ..	Valhe ..	Do. ..	1st May 1916 to 30th April 1917.
„ K. H. Pochkhanevala.	Bombay ..	General Horticulture	1st August 1916 to 28th April 1917.
„ G. R. Mohrir ..	Indi ..	Do. ..	19th January 1917 to 14th July 1917.

The usual training was given to students of the College of Agriculture. The students of the Training College for Men also visited the garden occasionally. The Arboricultural course for P. W. D. subordinates was conducted as last year, with marked success.

Two B.Sc. students are working for their M.Sc. degree under the Economic Botanist's direction. The courses in the Ganeshkhind Botanical Garden are now standardized and are (1) a one year's course for men of horticultural education less than the B.Ag. standard ; (2) a six weeks' course for members of agricultural departments ; (3) a course for men taking the C curriculum of the B.Ag. degree syllabus, and men desiring post graduate training. Two paid posts for mális under training have been sanctioned. A successful grafting class was held at Sátára in the hot weather of 1917.

Publications.

Article.	Author.	How published.
Training in Field observation ..	W. Burns, Economic Botanist.	Agricultural Journal of India, January 1917.
Models to illustrate segregation and combination of Mendelian characters.	H. M. Chibber, 2nd Economic Botanist.	Agricultural Journal of India. Special Science Congress number, 1916.
Experiments in the improvement of Sand Dunes.	M. V. Kelkar, Fieldman, Ganeshkhind Botanical Garden.	Agricultural College Magazine, July 1916.

Article.	Author.	How published.
Points regarding the selection of grafts for planting.	P. G. Joshi, Superintendent, Ganeshkhind Garden.	Agricultural College Magazine, October 1916.
A Fruit survey in some Parts of Sáswad Táluka (Poona District).	S. H. Prayag, B.Ag., Graduate Fieldman.	Agricultural College Magazine, January 1917.
Remedies against mildew ..	G. B. Patwardhan, Assistant Professor of Botany.	"Shetki and Shetkari" (Maráthi), October 1916, January 1917.
Note on Guava cultivation in Gujarát.	L. B. Kulkarni, L.Ag., Graduate Fieldman.	Agricultural College Magazine, October 1916.
On the mode of infection and prevention of smut disease of sugarcane.	S. L. Ajrekar, B.A., Assistant Professor of Mycology.	Agricultural Journal of India, July 1916.
On Fungoid diseases of plants..	Do. ..	"Shetki and Shetkari" (Maráthi), April 1916, June 1916, September 1916 and October 1916.
Some wild Fodder Plants of the Bombay Presidency.	W. Burns, R. K. Bhide, L. B. Kulkarni and Hanmante.	Bulletin No. 78 of 1916 of the Bombay Department of Agriculture.

Lectures have been delivered at exhibitions and public gatherings as usual.

RESEARCH AND DEMONSTRATION.

Mango.—Study of propagation methods was continued. It has been shown that the mango scion will not flower until it is itself sufficiently mature, even if it is grafted on a mature stock. Great success has attended the trapping of mango flies by using a distillate of the *Tulsi* (*Ocimum sanctum*) plant. This method was devised by Mr. Ram Rao Karsargode, Assistant Professor of Entomology. Spraying against mango hoppers with crude oil emulsion has not proved effective. Spraying with water during flowering interferes with the setting of fruit and confirms the belief in the detrimental effect of rain at this period. Mango "stones" travel best packed in dry charcoal powder. No canning was done this year as tins cannot be got.

Citrus.—Incosopol (a product of the Indian Cotton Oil Co., Navasári) has proved an effective remedy for aphis on citrus. The Nágpur orange plantation did not respond to the treatment given to force flowering first in January and then in July 1917. Kagadi limbu (small sour lime) plants, however, flowered profusely in June 1917 and set much fruit under the same treatment. Steady soil improvement by green manuring, addition of artificials, correct cultivation and watering has reclaimed an almost hopeless orange plantation near Mánjri, and greatly improved a fair plantation near Valhe. The sucking moth (*Ophideris fullonica*) has been traced as the cause of considerable falling of citrus fruits and measures are being devised against it.

Guavas.—The plants trained on wire are now bearing a luxuriant first crop on the lowest wire. The other wires are rapidly filling and a completely successful experiment is probable. This method of training will probably revolutionize guava culture in the Deccan. Varieties continue to be tested with a view to selection and propagation of the best flavoured and fewest seeded. The attempt to reduce seeds by continued vegetative propagation is being continued, but does not seem promising. As trees mature the percentage of sugar in the fruits rises. The stock has no effect on the colour of the scion fruit.

Papaya.—The crosses made show that the production of pure male plants can be eliminated by the use of hermaphrodite plants as pollen plants. This is one step on the way towards a race of papaya with a large proportion of female plants. Propagation by cuttings was not successful on a field scale as the cuttings were apt to rot at the base. The artificial branching of the papaya by cutting the top results in low stocky trees and an increased number of fruits.

Grapes.—Fish manure given after an exposure of the roots in the hot weather proved poisonous to young bearing plants. A very bad attack of anthracnose resulted from the late heavy rains. Our methods of combating this disease are undergoing improvement. French and American table grape varieties have been introduced and are under trial.

Figs.—The attempt to force two fruiting seasons into the dry months of the year has so far been unsuccessful. Scientific pruning resulted in considerable increase of crop. Covering trees by nets saved much of the fruit previously attacked by birds or stolen by men, but much is still lost. Varieties from the Punjab have been introduced. Foreign (European) varieties will not keep their fruits on the trees.

Banana.—As this is an important food crop much attention has been devoted to it and many new facts recorded. A paper embodying these was read before the 1917 Indian Science Congress at Bangalore but has not been published. The use of Dr. Mann's artificial manure

mixture has given marked increase in yield. Crosses of wild and cultivated bananas, and of cultivated varieties among each other, have been made. A careful scientific study is being made of the causes of seedlessness in bananas. The profit and loss of banana cultivation has been worked out. Properly done, a profit of Rs. 400 per annum per acre should result. Fifty-two Indian and foreign varieties have been planted for study and selection.

Rice.—Further study of the progeny of hybrids has given valuable data regarding the behaviour of plant characters in breeding. The rice classification has been amended and improved.

Wild Fodder Plants.—Our information up to date has been embodied in the bulletin mentioned under "Publications." The two acres of land in the estate of His Excellency the Governor were sown to selected wild fodder plants and gave 16,050 lbs. good fresh grass per acre. The land was given an additional slight seeding (30 lbs. per acre) of perennial grasses and will be grazed in the second year.

Plant Diseases.—The work against the *Koleroga* of betelnut palms has been extended and intensified. Many sprayers have been disposed of. The scientific data regarding jowar smuts are now complete and will be issued shortly as a memoir. A study of the field and storage rots of potato is in progress. Spraying against grape mildew is being done at Limbgoa. Many fungi have been reported on and remedies suggested.

The Economic Botanist has purchased packed and supplied Rs. 9,000 worth of vegetable seed to Mesopotamia during the year.

APPENDIX J.

WORK DONE UNDER THE AGRICULTURAL ENGINEER FOR THE YEAR ENDING 30TH OF JUNE 1917.

I held charge of the post of Agricultural Engineer, Bombay Presidency, during the year under review except for the months of October and November when I was away on privilege leave and Mr. Thiselton-Dyer, Mechanical Engineer to Government, acted during my absence.

Mr. Paranjpe, my Assistant, enjoyed one month's privilege leave, also Mr. Chitale, my Boring Overseer; but no other changes of importance took place.

I have to record a year's work during which many obstacles to progress have presented themselves, all of which are principally the result of the present European crisis. I refer of course partly to the difficulty in obtaining unskilled labour but mostly to the chaos in the machinery market. I have had 70 enquiries for pumping plants, two of which have matured, the others failed to mature partly on account of the machinery not being obtainable, but mostly on account of the exorbitant price.

During the last few months the question of spares has arisen, and had it not been for my workshop I am afraid many plants would have had to stand; in other words I am with the aid of my staff and workshop able to keep most plants going without having to appeal either to Agents in Bombay or Manufacturers in England and America. This applies to the pumping, boring, steam ploughing and all other sections of my department.

SUMMARY OF WORK DONE.

During the year under review 14 power plants have been erected, 1,635 acres and 37½ gunthas of land have been ploughed, 159 bores have been made and repairs to 12 existing power plants have been effected.

The above work represents the net result to the cultivator, the producing of which has involved much executive work in the way of surveying, inspecting, estimating, designing and setting out; much time has also been taken up in modifying tools, training men and rectifying mistakes when men have had difficulties to meet with. I am pleased to be able to say however that there is an improvement all round in the work done.

EXPERIMENTAL WELL AND WORKSHOP.

The various methods employed for raising water will shortly be demonstrated on the experimental well and it is hoped that the cultivators and those interested in Agriculture will avail themselves of this excellent opportunity of seeing the methods of raising water in actual operation. The object of this experimental well is to ascertain the simplest and most efficient plants for raising water under certain conditions. Users of mechanism of any kind have as a rule a dread of anything complicated and in designing implements and machinery for use on the farm simplicity is a consideration which manufacturers are too keen to overlook, and for this reason I am making tests and certain modifications so as to place before the cultivator the best possible method of raising water for his immediate needs.

MECHANICAL CULTIVATION.

Ránebennur.

During the year under review 608 acres and 8½ gunthas of land situated in the Ránebennur Táluka of the Dhárwár District have been ploughed to a depth varying from 16 to 18 inches; were climatic conditions favourable in this táluka I could easily count on doing 800 acres per season and then the project would pay handsomely; as it is however the receipts are only just sufficient to cover expenses. This is the fourth year ploughing operations have been performed and it would be as well to take the average of acres ploughed since the commencement.

Since 1913 up-to-date we have ploughed 2,561 acres and 11½ gunthas which is an average of 640 acres 13 gunthas per season. The total receipts are Rs. 56,844-1-7 (which does not include spares worth Rs. 6,208-8-2) and the total expenditure Rs. 75,253-6-11; this is allowing for interest and depreciation each year for the period under reference which means a loss of Rs. 12,200-13-2. If the question of interest and depreciation is waived we can effect a saving of Rs. 547-12-8 per season after paying all other expenses, and I strongly urge that this plan be adopted in the future, as owing to the short season at our disposal it is impossible to get better results.

The cultivators are very well pleased with the work and this is not to be surprised at seeing that they have such bumper crops as the result of deep ploughing. As regards ploughing charges I think it inadvisable to increase the rate for the time being, besides, taking one year with another it is obvious that we can meet actual expenses and have a little over, although it would be much better if we had sufficient to allow for interest and depreciation each year. But this can only be done by either increasing the rate or extending the ploughing season, and as the former will probably cause disastisfaction amongst the cultivators, and the latter impossible of accomplishment we must either move the tackle to another district or carry on as we are doing, and as the ploughing charges cover all working expenses, I think it advisable

to continue the work in the Ránebennur Táluka, because there is no direct loss to Government and the benefit to the cultivators is unquestionable. The balance sheet for this year will be found at the end of this report.

Gujarát.

This project is passing through a transitory period. We started the first year with the problem of arriving at the most suitable implement to do the work; then there came the question of secondary operations and a suitable charge to cover expenses; the third difficulty was the influx of a lot of cheap labour into the district owing to famine conditions which prevailed; then came the rain and a great scarcity of labour which afforded excellent scope for the plough; and cultivators who demurred in the first year at having more than one operation and of paying more than Rs. 12 per acre clamoured in the third year for three operations and willingly offered to pay Rs. 27 per acre for the work done. This augurs well for the future as I am inclined to think that even when all the virgin land is broken up there will still be a demand for the plough for ordinary cultivation. I have been in difficulties this year on account of the congestion of traffic on the railways which has affected the supply of coal and the procuring of cultivator points locally owing to the supplies being stopped from Home. Towards the close of the present ploughing season a slight accident occurred to one of the boilers but this was the fault of the Engineer-in-charge who has since been transferred. During the season under report 282 acres and 14 gunthas have been ploughed each having 3 operations, 733 acres and 14 gunthas having 2 operations and 12 acres and 1 guntha having one operation, total area covered 1,027 acres and 29 gunthas.

Owing to the difficulties enumerated above however I shall not be able to set aside anything for interest and depreciation, but all other expenses can be met. There is plenty of land booked for next season.

MOTOR PLOUGH.

Further experiments have been made with this plough to discover how far it is applicable to Indian Agricuture and some of the weak points have been overcome and I shall shortly be in a position to specify for a plough exactly suited to Indian conditions. A Motor plough should have ample power to deal with its work under all conditions. It should have power and to spare and should do even the hardest work easily and within its powers. Far too many Tractors are under-powered and whilst able to do their work under normal conditions, get stalled when the work becomes severe and are at all times being worked to their maximum capacity which is not good for their internal economy and chances of long and useful life.

Ten or fifteen years ago, when Agricultural machines first came in for consideration, the opinion in which I shared—was pretty generally held that, as price was a matter of prime consideration and the work was rough, a large bore single-cylinder engine would be the most suitable. But further consideration and experience would appear to disprove this, and at any rate all the trend of development at the present time is in the direction of multi-cylinder engines, and particularly of four cylinder engines, on account of their superior torque and ability to hang on to their work under severe conditions. Of course some form of paraffin vaporizer is now a necessity owing to the shortage of petrol, and no farm engine should be without an efficient governor. Such engines should work satisfactorily on paraffin, as farm work is very much more akin to marine and stationary work, than to Motor Car work, as the engines are for the most part working continuously under constant load and being governed—at constant speed, and have not the wide variations of load and speed which the touring car and motor wagon engines have to deal with. Another point which is important has reference to the provision of means for preventing skidding or driving slip on very soft or slippery ground. These are some of the features with which I have to deal before recommending the Motor plough to the Indian cultivator. There is nothing so certain however as that the Motor plough and mechanical methods of cultivation on the land have come to stay.

BORING.

The total number of bores made for the whole of the Presidency is 159 and the percentage of success 84·09. Thirty-one machines have been engaged during the season with an average of 5 bores per machine per season. The total number of gallons tapped amount to 242,120, or in other words 2,081·2 gallons per bore per hour. The total depth bored for all machines is 8,853·feet, or 285′–7″ per machine. The total cost for all the bores including labour, shoes, mukadam's pay including travelling allowance but exclusive of machine depreciation, etc., amounts to Rs. 26,043-0-0 or Rs. 840-0-0 per machine and Rs. 236-12-0 per bore. The average cost per foot amounts to Rs. 2-15-0 and the cost per thousand gallons tapped amounts to Rs. 107-9-0.

I particularly wish to point out the work done in Upper Thána. During the season under review 17 bores have been made and three are progressing, and water has been tapped in every case, one bore at Tembi is supplying 9 Koses of water, another at Umbergaon 2½ Koses. Some of the bores were made from the surface and the owners have commenced to make wells as the supply is sufficient for irrigation purposes; another bore made at Párdi from the bottom of an existing well is giving a supply of 2,160 gallons per hour. This is an interesting result

as the strata is soft rock and the district promises to offer plenty of scope for boring operations, and I have plenty of enquiries.

Broach.

Previous bores made in the Broach District have produced brackish water, but last season three bores were made and in each case sweet water has been struck; another bore is at present in progress and what has been hitherto considered to be a bad district now promises to offer scope for boring operations. There are plenty of enquiries to hand.

Kolába.

The prospects in this district are not very promising as three bores have been made and only one has produced sufficient water for domestic purposes at a depth of 193 feet from the surface.

Sind.

A bore has been made to a depth of 200 feet from the surface on the Willingdon Cattle Farm Site near Karáchi and water has been struck, but it is decidedly brackish; other bores are about to be made at this site but at present I am fitting up the boring machine with an engine as it is impossible to get good results with the coolies available. A pumping plant is also being prepared to test the sub-soil water at this site.

Next season I propose to give the following districts special attention, *viz.*, Sind, Panch Maháls, Konkan and East Deccan. A full statement is appended at the end of this report giving particulars of each bore in detail.

OIL ENGINE DRIVING CLASS AND TRAINING OF STUDENTS.

This promises to be a very important section of my work, in connection with the experimental well and workshop. During the past year I have had 60 applications; nineteen have been trained and six are under training. I have four students from Indore and two from the Military Authorities, Aurangabad. The Agricultural Expert from Jhalawad State has also taken a course in oil engine driving and boring during the year under report. The workshop and experimental well are particularly adapted for this tuition, and I am extremely anxious to keep both up-to-date.

Total number of enquiries during the year under review—

Cane Crushing	..	9
Power Plough	..	18
Ginning	..	5
Oil Engine Class	..	60
Pumping	..	70
Boring	..	134
Blasting	..	2
		298

KOPERGAON SHREDDING AND BALING PLANT.

This plant is practically complete now, has been running most of the season and has given fairly good results. The total initial outlay amounts to Rs. 18,292-7-9, but this is a considerable increase on the original estimate which is due to the enhanced price as the result of the war. The plant is capable of dealing with 3,000,000 lbs. of Kadbi in 6 months or 41,666 bales each weighing on an average 72 lbs. The size of the bale is 30″ × 14″ × 18″ a very convenient size for transport purposes and the density varies from 16 to 20 lbs. per cubic foot. The actual cost per bale is Rs. 0-2-5; this is allowing for interest and depreciation on the plant, labour charges, supervision and fuel.

I believe it is the only plant of its kind in India, but I anticipate a demand for such plants when prices once more become normal and of course provided this one we have fixed at Kopergaon proves to be statisfactory after a prolonged test. The machinery however is the best I can get and the whole thing has been carefully thought out.

To prevent the engine standing unnecessarily two cane crushers have been fixed so that except during the monsoon months the engine is fully employed. I hope to give a more explicit report next year.

GENERAL REMARKS.

My department has been busily engaged during the year in dealing with the many problems connected with Agricultural engineering and it is gratifying to note that the work done is very much appreciated by the cultivators. There is a tremendous scope throughout the Presidency for the activities of my department and much work will still have to be done in the way of experimenting with various machines from time to time, with a view to ascertain the best and cheapest and most applicable machines for the Indian cultivator. We are already dealing with power pumping, boring, mechanical cultivation, cane crushing, ginning, milling

and shredding, and the applications from Agriculturists to join the Oil Engine Driving Class and attend at the workshops certainly goes to prove that the Indian Cultivator is waking up to the possibilities of modern implements and machinery. Our experience and figures undoubtedly foreshadow a much freer adoption of modern machinery in India in the near future. The oil engine, power propelled plough and power crusher have certainly come to stay. Scientific Agriculture involves the use of these implements and machinery and although India will not for some time be a large consumer of farming mechanism it is gratifying to note that a good start has been made. Until quite recently labour has been abundant and cheap in India, but is now becoming a problem which the Indian Cultivator will have to take seriously. This augurs well for labour saving machinery and I take not a little pride in the fact that although my department has been a great help in the past it will still be a greater help in the future.

W. M. SCHUTTE, A. M. I.Mech. E.,

Agricultural Engineer to Government, Bombay Presidency, Poona.

BALANCE SHEET OF KAIRA STEAM PLOUGH FOR THE III SEASON ENDING 30TH JUNE 1917.

Dr.					*Cr.*			
		Rs.	a.	p.		Rs.	a.	p.
Establishment	..	4,504	6	8	Ploughing charges ..	19,844	5	7
Repairs	..	916	7	3	Miscellaneous Receipts ..	37	8	0
Purchase of Implements	..	4,131	8	6	Cost of new cultivator ..	3,400	0	0
Haulage of Coal and Water		3,443	1	6	Stores on hand ..	11,345	15	11
Peons' Uniforms and Belts	..	10	8	0				
Purchase of Tools and Plants		21	4	0				
Purchase of Stores	..	9,457	9	4				
Fuel	..	5,801	4	9				
Miscellaneous charges	..	343	10	9				
Labour	..	477	1	9				
Rent	..	43	0	0				
Postage	..	50	0	0				
Previous year's stock on hand.		5,296	10	6				
Balance by profit	..	131	4	6				
Rs.	..	34,627	13	6	Rs. ..	34,627	13	6

BALANCE SHEET OF RANEBENNUR STEAM PLOUGH FOR THE IV SEASON ENDING 30TH JUNE 1917.

Dr.					*Cr.*			
		Rs.	a.	p.		Rs.	a.	p.
Establishment	..	4,273	6	4	Ploughing charges ..	15,205	0	0
Repairs	..	59	14	0	Miscellaneous Receipts ..	610	0	0
Miscellaneous charges	..	740	15	0	Cost of stock on hand ..	6,208	8	2
Fuel	..	4,059	0	9	Minus Balance ..	727	9	5
Stores	..	3,700	5	6				
Haulage of coal and water	..	2,030	4	0				
Previous year's stock on hand.		7,887	4	0				
Rs.	..	22,751	1	7	Rs. ..	22,751	1	7

W. M. SCHUTTE, A. M. I. Mech. E.,

Agricultural Engineer to Government, Bombay Presidency, Poona.

Detailed statement of bores taken during the year 1916-17.

Serial Number.	Name of well owner.	Taluka.	Village.	Diameter of bore hole.	Depth of boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of bore hole.	Cost per foot.	Result and Remarks.
	GUJARAT. *Kaira District.*			Inches.	Ft. In.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
1	Sanitary Board Well ...	Anand ...	Sarsa ...	2½	80 0	500	4,000	189 4 0	118 0 0	307 4 0	3 13 5	Successful.
2	Mr. Harmanbhai Dungarbhai.	Do. ..	Samerkha ...	4	50 0	1,000	8,000	208 7 6	21 12 0	230 3 6	4 9 8	Do.
3	Mr. Chhagan Garbad ...	Nadiad ...	Keriavi ...	3	...	...	...	.....	.....	.....	...	Failure.
4	,, Ajubhai Muljibhai...	Anand ...	Samerkha ...	2½	54 0	1,000	5,000	138 13 11	25 11 0	164 8 11	3 0 9	Successful.
5	Nadiad Farm Well ...	Nadiad ...	Nadiad ...	3	...	...	...	.....	.....	.....	...	Incomplete.
6	Mr. Chhagan Garbad ...	Do. ...	Keriavi ...	3	76 0	500	2,000	191 14 7	51 5 0	243 3 7	3 3 2	Successful
7	,, Punjabhai Hattibhai	Anand ...	Chikhodra ...	4	63 0	1,000	6,000	254 0 11	34 0 0	288 0 11	4 15 6	Do.
8	Local Board Well ...	Mehmdabad .	Aklacha ...	2½	178 0	Nil.	100	412 10 4	556 13 1	969 7 5	5 7 2	Do.
9	Mr. Mathurbhai Talsibhai.	Anand ...	Chikhodra ...	2½	90 0	1,000	4,000	211 2 2	45 5 0	256 7 2	2 13 7	Do.
10	Nadiad Municipality ...	Nadiad ...	Nadiad ...	3	65 0	1,000	6,000	187 15 0	60 8 0	248 7 0	3 13 0	Do.
11	Mr. Nathabhai Gorabhai	Do. ...	Keriavi ...	3	119 0	250	1,250	322 12 4	157 9 0	480 5 4	4 7 0	Do.
12	Mr. Galabhai Kashibhai.	Do. ...	Bhumel ...	3	66 0	100	1,000	184 5 1	34 0 0	218 5 1	3 4 11	Do.
13	Local Board Well V ...	Anand ...	Devpura ...	2½	80 0	Nil.	2,000	191 9 3	104 4 0	295 13 3	3 11 2	Do.
14	Mr. Mathoorbhai Kalidas.	Do. ...	Chikhodra ...	4	...	...	...	.....	.....	.....	...	Incomplete.
15	Mr. Kashibhai Bhawanidas.	Borsad ...	Saijpur ...	4	88 0	2,000	6,000	372 10 5	132 8 0	505 2 5	5 11 10	Successful.
16	Mr. Galabhai Kashibhai.	Nadiad ...	Bhumel ...	3	90 0	1,000	3,000	232 8 6	64 4 0	296 12 6	3 4 9	Do.
17	,, Chatoor Kala ...	Anand ...	Devpura ...	2½	...	...	...	.....	.....	.....	...	Failure.
18	Mr. Jiwanpuri Hardaspuri.	Do. ...	Navli ...	4	17 0	1,000	6,000	83 3 4	14 4 0	97 7 4	5 11 9	Successful.
19	Mr. Hathibhai Shankerbhai.	Nadiad ...	Bhumel ...	3	50 0	1,000	10,000	141 5 2	33 10 0	174 15 2	3 8 0	Do.
20	Mr. Muljibhai Narayanbhai.	Do. ...	Mahuda ...	2½	30 0	Nil.	1,000	81 9 8	47 4 0	128 13 8	4 4 9	Do.
21	Mr. Bana Dhana ...	Mehmdabad .	Chapara ...	2½	47 0	500	1,500	58 10 2	95 12 0	154 6 2	3 4 7	Do.
22	,, Manilal Chhaganlal.	Nadiad ...	Mahuda ...	2½	...	...	...	.....	.....	.....	...	Failure.
23	,, Lalloobhai Lalaji ...	Anand ...	Vansole ...	4	117 6	2,000	6,000	524 12 9	82 15 0	607 11 9	5 2 9	Successful.
24	,, Somabhai Haribhai.	Nadiad ...	Uttersunda ...	3	69 0	1,000	3,000	183 14 10	32 0 0	215 14 10	3 2 1	Do.
25	,, Jiwanpuri Hardaspuri.	Anand ...	Navli ...	4 & 2½	125 0	6,000	8,000	560 11 10	300 0 0	860 11 10	6 14 2	Do.
26	Mr. Mathoorbhai Muljibhai.	Nadiad ...	Uttersunda ...	3	...	...	...	.....	.....	.....	...	Failure.
27	Mr. Sana Lalloobhai ...	Mehmdabad .	Chapara ...	2½	25 0	1,000	2,000	63 8 4	30 12 0	94 4 4	3 12 3	Successful.
28	,, Muljibhai Narayanbhai.	Nadiad ...	Mahuda ...	3	19 6	500	1,500	69 7 8	16 2 0	85 9 8	4 6 3	Do.
29	Mr. Jiwanpuri Hardaspuri.	Anand ...	Navli ...	3	...	...	...	.....	.....	.....	...	Incomplete.
30	Mr. Sanabhai Lalloobhai	Mehmdabad .	Chapra ...	2½	47 0	2,000	4,000	112 9 0	48 0 0	160 9 0	3 6 8	Successful.
31	,, Jethabhai Shankerbhai.	Anand ...	Ráhtalol ...	3	57 0	1,000	11,000	137 1 6	8 12 0	145 13 6	2 8 11	Do.
32	Mr. Keshavlal Motiram .	Nadiad ...	Bhaner ...	2½	...	...	...	.....	.....	.....	...	Incomplete.
33	,, Dadoobhai Parsottam.	Do. ...	Nadiad ...	3	59 0	1,000	7,000	158 4 11	39 7 0	197 11 11	3 5 8	Successful.
34	Mr. Nanubhai Samalbhai.	Anand ...	Samerkha ...	3	99 0	8,000	12,000	259 10 9	76 0 0	335 10 9	3 6 3	Do. 20 B. H. P. oil engine and 4" Pump is working.
35	Mr. Mohanlal Gulabchand.	Kapadwanj ...	Kathlal ...	2½	...	...	...	.....	.....	.....	...	Incomplete.
36	Mr. Shiva Baji ...	Anand ...	Ráhtalol ...	3	56 0	200	2,200	125 12 10	37 0 0	162 12 10	2 14 6	Successful.
37	,, Kashibhai Bhanidas.	Borsad ...	Saijpur ...	4	95 0	1,000	3,000	446 14 11	134 8 0	581 6 11	6 1 11	Do.
38	,, Natha Gala ...	Mehmdabad .	Chapara ...	2½	49 0	250	2,250	115 14 7	41 4 0	157 2 7	3 3 4	Do.
39	,, Dadoobhai Parsottam.	Nadiad ...	Nadiad ...	3	...	...	...	.....	.....	.....	...	Incomplete.
40	Mr. Laloobhai Mathoorbhai.	Anand ...	Bhalej ...	2½	24 0	1,000	4,000	55 3 8	10 0 0	65 3 8	2 11 6	Successful.
41	Mr. Maganlal Manilal ...	Nadiad ...	Kanjari ...	3	60 0	1,000	3,000	158 13 4	50 0 0	208 13 4	3 7 8	Do.
42	,, Gala Nana ...	Mehmdabad .	Chapara ...	2½	...	...	...	.....	.....	.....	...	Failure.
43	,, Jiwanpuri Haridaspuri.	Borsad ...	Ashi ...	2½	172 0	1,000	7,000	402 7 5	127 7 6	529 14 11	3 1 4	Successful.
44	Tank Well ...	Thasra ...	Dakor ...	4	...	...	...	.....	.....	.....	...	Failure.
45	Mr. Babar Daji ...	Anand ...	Ráhtalol ...	3	52 0	1,000	7,000	141 6 1	20 0 0	161 6 1	3 1 8	Successful.
46	Nadiad Farm Well ...	Nadiad ...	Nadiad ...	6	...	...	...	.....	.....	.....	...	Failure.
47	Mr. Narsibhai Jhaverbhai.	Anand ...	Ráhtalol ...	3	...	...	...	.....	.....	.....	...	Do.
48	Mr. Dhulabhai Jadevbhai.	Do. ...	Navli ...	3	35 0	2,000	3,500	100 14 5	22 9 0	123 7 5	3 8 5	Successful.
49	Nadiad Farm Well ...	Nadiad ...	Nadiad ...	6 & 4½	...	...	...	.....	.....	.....	...	Incomplete.
50	Mr. Somabhai Mathurbhai.	Anand ...	Navli ...	3	78 0	500	1,500	190 2 7	37 11 0	227 13 7	2 14 9	Successful.
51	Mr. Mathoorbhai Muljibhai.	Nadiad ...	Uttersunda ...	3	50 0	500	2,500	143 1 3	21 0 0	164 1 3	3 4 4	Do.
52	Mr. Narsibhai Jhaverbhai.	Anand ...	Ráhtalol ...	3	34 6	2,000	6,000	95 5 1	10 0 0	105 5 1	3 10 0	Do.
53	Mr. Babarbhai Mathoorbhai.	Do. ...	Do. ...	3	41 0	1,000	11,000	116 8 6	28 0 0	144 8 6	3 8 5	Do.
54	M. Jivabhai Nathabhai .	Nadiad ...	Chaklashi ...	3	...	...	...	.....	.....	.....	...	Incomplete.

Serial Number.	Name of well owner.	Taluka.	Village.	Diameter of bore hole.	Depth of boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of bore hole.	Cost per foot.	Result and Remarks.
	Kaira District—contd.			Inches.	Ft. In.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
55	Mr. Shivabhai Narandbhai.	Anand ...	Ráhtalol ...	3	42 0	500	4,500	118 15 9	27 0 0	145 15 9	3 7 7	Successful.
56	Mr. Lallubhai Nanabai...	Nadiad ...	Uttersunda ...	3	64 0	3,000	5,000	187 3 3	85 0 0	272 3 3	4 4 1	Do
57	,, Ichhabhai Dwarkadas.	Anand ...	Bhalej ...	3	43 0	1,000	6,000	112 14 0	5 12 0	118 10 0	2 12 2	Do.
58	Mr. Moti Kishor ...	Do. ...	Ráhtalol ...	3	52 0	1,000	9,000	142 9 8	29 0 0	171 9 8	3 4 10	Do.
59	,, Bechar Kishor ...	Matar ...	Vasnabiyarga.	2½	...	...	...	.....	.....	.....	...	Failure.
60	,, Mahiji Zera ...	Anand ...	Ajarpura ...	3	56 0	1,000	5,000	146 8 1	22 0 0	168 8 1	3 0 2	Successful.
61	,, Madheolal Jhaverilal	Nadiad ...	Piplata ...	3	28 0	1,000	5,000	88 11 0	30 1 0	118 12 0	4 3 10	Do.
62	,, Mathoorbhai Kalidas.	Anand ...	Bhalej ...	3	67 0	1,000	7,000	170 3 11	16 10 0	186 13 11	2 12 8	Do.
63	Mr. Miya Remu Sujatmiya.	Do. ...	Do. ...	3	...	...	...	.....	.....	.....	...	Failure.
64	Mr. Ratanlal Shankerlal.	Borsad ...	Davalpura ...	4	...	...	...	.....	.....	.....	...	Incomplete.
65	,, Govindbhai Kashibhai.	Nadiad ...	Chaklashi ...	3	...	...	...	.....	.....	.....	...	Failure.
66	Mr. Miya Remu Sujatmiya.	Anand ...	Bhalej ...	3	44 0	1,000	7,000	117 5 9	28 2 0	145 7 9	3 4 11	Successful.
67	Mr. Motibhai Nagarbhai.	Do. ...	Samerkha ...	3	36 0	250	6,250	97 12 4	9 12 0	107 8 4	2 15 9	Do.
68	,, Desaibhai Manorbhai.	Do. ...	Lingada ...	3	48 0	1,000	11,000	129 2 8	28 0 0	157 10 8	3 4 7	Do.
69	Do. ...	Do. ...	Do. ...	3	...	...	...	.. ...	.....	.....	...	Incomplete.
70	Local Board Well ...	Thasra ...	Vithalpura ...	6	260 0	Nil.	480	1,663 14 9	279 9 0	1,913 7 9	7 5 9	Successful.
71	Mr. Desaibhai Nagarbhai.	Matar ...	Sandhana ...	2½	96 0	2,000	6,000	267 2 5	180 0 0	447 2 5	4 10 6	Do.
72	Mr. Soma Khoda ...	Nadiad ...	Bhumal ...	3	115 0	250	1,250	259 7 5	200 0 0	459 7 5	3 15 11	Do.
73	,, Motibhai Vithabhai.	Anand ...	Samerkha ...	2½	56 0	1,000	5,000	165 1 8	53 0 0	218 1 8	3 4 10	Do.
	Ahmedabad District.											
74	Mr. Trikam Harkji ...	Dholka ...	Dholka ...	3	18 0	250	1,000	57 7 5	13 14 0	71 5 5	3 15 5	Do.
75	,, Parsottam Hirabhai.	Do. ...	Do. ...	3	47 0	Nil.	500	103 1 0	35 1 0	138 2 0	2 15 0	Do.
76	,, Brahmachari Nityanand.	Do. ...	Do. ...	3	18 0	Nil.	500	56 10 9	13 8 0	70 2 9	3 14 4	Do.
77	Mr. Thakor Dhipsingji...	Tintoi ...	Tintoi ...	4	...	...	...	.....	.....	.....	...	Failure.
78	,, Somabhai Jiwabhai.	Dholka ...	Dholka ...	3	73 0	250	1,000	191 10 1	76 0 0	267 10 1	3 10 8	Successful.
79	,, Lalloobhai Varadbhai.	Do. ...	Do. ...	3	68 0	250	750	148 15 1	38 0 0	186 15 1	2 12 0	Do.
80	Mr. Madha Bhagwan ...	Prantij ...	Majra ...	4	23 0	560	2,500	121 8 6	35 4 0	156 12 6	6 13 1	Do.
81	,, Amtha Hira ...	Do. ...	Tajpur ...	4	83 0	200	1,200	367 9 6	299 15 0	667 8 6	8 0 8	Do.
82	,, Maneklal Chaganlal.	Dholka ...	Dholka ...	3	65 0	500	1,500	163 11 2	72 12 0	236 7 2	3 10 2	Do.
83	,, Nariman Rattonji ...	Sanand ...	Changodar ...	3	115 0	1,000	2,000	306 1 2	75 0 0	381 1 2	3 5 0	Do.
84	,, Rema Mulji ...	Prantij ...	Tajpur ...	4	64 0	500	1,500	292 1 1	131 6 0	423 7 1	6 9 10	Do.
85	,, Nariman Rattonji ...	Sanand ...	Changodar ...	3	36 6	2,000	4,000	105 7 0	25 0 0	130 7 0	3 9 2	Do.
86	,, Bapuji Vaktoji ...	Prantij ...	Balisana ...	4	53 0	500	2,500	238 13 5	88 4 0	327 1 5	6 2 9	Do.
87	,, Nariman Rattonji ...	Sanand ...	Tajpur ...	3	142 0	250	2,000	376 4 10	141 12 0	518 0 10	3 10 4	Do.
88	Aduana Mills ...	Ahmedabad .	Ahmedabad .	4	73 0	1,000	2,000	314 13 9	142 0 0	456 13 9	6 4 2	Do.
89	Shri Ramkrishna Mills...	Do. ...	Do. ...	4	37 0	1,000	2,000	197 9 6	103 0 0	300 9 6	3 2 0	Do.
90	Mr. Ramchandra V. Sant.	Dholka ...	Badarkha ...	3	...	...	...	.....	.....	.....	...	Incomplete.
91	,, Lalji Shamji ...	Prantij ...	Fatepur ...	2½	47 0	250	1,250	64 12 1	100 0 0	164 12 1	3 8 1	Successful.
92	,, Ranchod Atmaram...	Dholka ...	Dholka ...	3	50 0	1,000	3,000	149 4 1	56 10 0	205 14 1	4 1 11	Do.
	Broach District.											
93	Veterinary Dispensary ...	Broach ...	Broach ...	4	97 0	Nil.	240	438 4 3	254 2 0	692 6 3	7 2 3	Do.
94	Mr. Parsottam Ranchod.	Do. ...	Sahapur ...	4	32 0	500	1,500	148 10 11	40 0 0	188 10 11	5 14 4	Do.
95	,, Patel Chhita Jhaver.	Do. ...	Do. ...	4	31 0	225	1,225	217 9 4	41 0 0	258 9 4	8 5 6	Do.
96	,, Girdhar Ranchod ...	Do. ...	Do. ...	4	...	...	...	.....	.....	.....	...	Incomplete.
	Panch Mahals District.											
97	Fort Well ...	Dohad ...	Dohad ...	4	...	...	...	.....	.....	.....	...	Do.
98	Mr. Bamanji A. Dalal ...	Halol ...	Rastampura .	4	...	...	...	.....	.....	.....	...	Failure.
99	Do. ...	Do. ...	Do. ...	4	...	...	...	.....	.....	.....	...	Incomplete.
	Thana District.											
100	Mr. J. C. Mistri ...	Salsette ...	Malad ...	3	36 0	Nil.	540	5 4 11	24 8 0	29 12 11	0 13 3	Successful.
101	Do. ...	Do. ...	Do. ...	3	75 0	Nil.	1,260	9 4 8	40 0 0	49 4 8	0 9 2	Do.
102	Do. ...	Do. ...	Do. ...	3	50 0	Nil.	1,440	23 7 3	24 8 0	47 15 3	0 15 4	Do.
103	Do. ...	Do. ...	Do. ...	3	50 0	Nil.	310	62 12 5	46 0 0	108 12 5	2 2 8	Do.
104	Do. ...	Do. ...	Do. ...	3	56 0	Nil.	310	41 10 6	24 8 0	66 2 6	1 2 11	Do.
105	Do. ...	Do. ...	Do. ...	3	50 0	Nil.	310	34 10 5	24 8 0	59 2 5	1 2 11	Do.
106	Mr. V. A. Dabholkar ...	Do. ...	Khandivli ...	3	115 0	Nil.	240	12 4 5	85 0 0	97 4 6	0 13 9	Do.

Serial Number.	Name of well owner.	Taluka.	Village.	Diameter of bore hola.	Depth of boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of bore hole.	Cost per foot.	Result and Remarks.
	Thana District—contd.			Inches.	Ft. In.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
107	Mr. V. A. Dabholkar ...	Salsette ...	Khandivli ...	3	80 0	Nil.	240	5 9 2	30 0 0	35 9 2	0 7 1	Successful.
108	Do. ...	Do. ...	Do. ...	3	50 0	Nil.	240	3 9 9	20 0 0	23 9 9	0 7 7	Do.
109	Do. ...	Do. ...	Do. ...	3	81 0	Nil.	355	5 0 11	25 0 0	30 1 2	0 6 0	Do.
110	Do. ...	Do. ...	Do. ...	3	68 0	Nil.	240	5 4 5	30 0 0	35 4 5	0 8 4	Do.
111	,, J. R. De'Souza ...	Do. ...	Malad ...	3	57 0	Nil.	310	53 0 8	24 8 0	77 8 8	1 5 11	Do.
112	,, G. S. Dandekar ...	Mahim ...	Wakora ...	3	5 0	...	...	.....	.....	.....	...	Incomplete.
113	,, Kalidas Jagjiwandas.	Umbergaon Peta.	Umbergaon ...	3	30 0	500	3,000	48 12 0	50 0 0	98 12 0	3 4 1	Successful.
114	,, Tribhuwandas Gandabhai.	Do. ...	Tembi ...	3	23 0	750	10,500	66 7 6	9 0 0	75 7 6	3 4 6	Do.
115	Mr. V. K. Sanjanwala ...	Do. ...	Sanjan ...	3	35 0	Nil.	360	31 15 6	147 12 0	179 11 6	3 7 4	Do.
116	,, M. G. Marathe ...	Do. ...	Bardi ...	3	125 0	...	...	.....	.....	.....	...	Incomplete.
117	,, Kanayyalal Devichand.	Dahanu ...	Borlai ...	3	50 0	Nil.	240	63 2 1	40 0 0	103 2 1	2 1 1	Successful.
118	Do. ...	Do. ...	Do. ...	3	88 0	...	...	.....	.....	.....	...	Incomplete owing to mishap of tool.
119	Do. ...	Do. ...	Do. ...	3	71 0	...	...	.....	.....	.....	...	Incomplete.
	Nasik District.											
120	Mr. S. B. Palnitkar ...	Nasik ...	Nasik ...	3	40 0	Nil.	300	11 4 0	65 0 0	76 4 0	1 14 0	Successful.
121	,, S. B. Dhumal ...	Do. ...	Do. ...	3	30 0	Nil.	720	12 0 4	48 12 0	60 12 4	2 0 5	Do.
122	Do. ...	Do. ...	Do. ...	3	45 0	Nil.	720	52 13 2	87 8 0	140 5 2	3 1 10	Do.
123	,, G. N. Patankar ...	Do. ...	Do. ...	3	46 0	Nil.	360	111 6 6	53 1 0	164 13 6	3 9 4	Do.
124	,, D. S. Oak ...	Do. ...	Do. ...	3	26 0	Nil.	500	11 14 4	35 10 0	47 8 4	1 12 10	Do.
125	,, M. M. Jadhav ...	Do. ...	Do. ...	3	31 0	Nil.	360	30 10 2	38 4 6	68 14 8	2 3 7	
126	Trimbak Municipality ...	Do. ...	Trimbak ...	3	100 0	...	...	.....	.....	.....	...	Failure.
127	Mr. T. R. Chiplunkar ...	Do. ...	Mhasrole ...	3	25 0	...	...	.....	.....	.....	...	Do.
128	,, S. B. Palnitkar ...	Do. ...	Nasik ...	3	...	...	...	.....	.....	.....	...	Incomplete.
129	,, T. R. Chiplunkar ...	Do. ...	Mhasrol ...	3	26 0	...	...	.....	.....	.....	...	Failure.
	Kolaba District.											
130	Mr. B. M. Hodiwala ...	Uran ...	Mora ...	3	40 0	Nil.	Nil.	.....	.....	.....	...	Failure owing to mishap of tool.
131	Do. ...	Do. ...	Do. ...	3	137 0	Nil.	210	22 6 2	175 0 0	197 6 2	1 7 1	Successful.
132	,, D. C. Oomerigar ...	Do. ...	Do. ...	3	80 0	...	...	.....	.....	.....	...	Incomplete.
133	Panvel Local Board Well.	Panvel ...	Tare ...	3	30 0	...	...	.....	.....	.....	...	Do.
	Surat District.											
134	Mr. P. V. Bhiladwala ...	Pardi ...	Pardi ...	3	36 0	4,000	4,440	73 3 9	110 0 0	183 3 9	5 1 9	Successful 14 B. H. P. Oil Engine and 4 Pump is working.
135	Do. ...	Do. ...	Do. ...	3	134 0	4,000	6,160	77 10 7	296 0 0	373 10 7	2 12 7	Do.
	Satara District.											
136	Mr. R. R. Kale ...	Satara ...	Nele ...	3	50 0	...	...	.....	.....	.....	...	Failure.
137	,, N. R. Gujar ...	Karad ...	Masur ...	3	16 0	...	...	.....	.....	.....	...	Do.
138	Do. ...	Do. ...	Do. ...	3	194 0	...	...	.....	.....	.....	...	Do.
	Belgaum District.											
139	Experimental Bore ...	Gokak ...	Maldini ...	4	72 3	...	...	.....	.....	.....	...	Incomplete.
	Dharwar District.											
140	Mr. Kotrappa Teli ...	Karajgi ...	Devgiri ...	3	76 2	Nil.	240	65 14 9	185 0 0	250 14 9	3 7 9	Successful.
141	,, Huchacharya Gudi .	Do. ...	Do. ...	3	89 6	Nil.	240	54 10 6	103 2 0	157 12 6	1 2 0	Do.
142	,, D. R. Kulaskar ...	Do. ...	Do. ...	3	65 0	...	...	.....	.....	.....	...	Failure owing to mishap of tool.
143	Taluka Local Board ...	Ranibennur .	Angsapur ...	3	116 0	Nil.	315	69 3 0	128 6 0	197 9 0	1 11 3	Successful.
144	Do. ...	Do. ...	Kajri ...	3	95 0	Nil.	250	17 3 6	70 2 0	87 5 6	0 14 8	Do.
145	Hon. Mr. V. S. Naik ...	Do. ...	Ranibennur .	3	96 0	...	...	.....	.....	m...	...	Incomplete.
	Bijapur District.											
146	Taluka Local Board ...	Bagalkot ...	Manikatti ...	3	101 0	Nil.	240	79 14 8	250 4 0	330 2 8	3 4 3	Successful.
147	Do. ...	Do. ...	Bhagwati ...	3	76 8	Nil.	210	221 10 7	341 13 6	563 8 1	7 6 7	Do.
148	Bagalkot Municipality ...	Do. ...	Bagalkot ...	3	76 4	Nil.	215	19 2 3	58 4 0	77 6 3	1 0 3	Do.
	Sholapur District.											
149	The Sholapur Spinning and Weaving Co.	Sholapur ...	Sholapur ...	3	46 0	Nil.	240	88 11 0	189 12 0	278 7 0	6 0 9	Do.
150	Do. ...	Do. ...	Do. ...	3	142 0	Nil.	540	52 7 11	91 2 8	143 10 7	1 0 2	Do.
151	Do. ...	Do. ...	Do. ...	3	50 0	Nil.	360	38 13 2	204 6 0	243 3 2	4 13 9	Do.
152	Do. ...	Do. ...	Do. ...	3	46 0	Nil.	360	45 0 3	153 11 0	198 11 3	4 4 8	Do.
153	Do. ...	Do. ...	Do. ...	3	39 0	...	...	.....	.....	.....	...	Incomplete.

Serial Number.	Name of well owner.	Taluka.	Village	Diameter of bore hole.	Depth of boring.	Water before boring in gallons per hour.	Water after boring in gallons per hour.	Departmental charges.	Labour charges.	Total cost of bore hole.	Cost per foot.	Result and Remarks.
	Poona District.			Inches.	Ft. In.			Rs. a. p.	Rs. a. p.	Rs. a. p.	Rs. a. p.	
154	Experimental Bore ...	Haveli ...	Poona ...	4	60 0	Nil.	360	101 14 0	54 10 0	156 8 0	2 11 2	Successful.
155	Sir D. J. Tata ...	Do. ...	Do. ...	4	165 0	...	...	.....	.....	.....	...	Failure.
156	Paisa Fund Glass Works.	Mawal ...	Talegaon ...	4	63 0	Nil.	240	67 12 10	46 6 1	114 2 11	1 13 1	Successful.
157	Do. ...	Do. ...	Do. ...	4	100 0	Nil.	240	52 12 0	73 9 11	126 5 11	1 4 3	Do.
158	Mr. G. D. Ghule ...	Haveli ...	Dapuri ...	4	...	...	...	.....	.....	.....	...	Incomplete.
	Karachi District.											
159	Willingdon Cattle Farm.	Karachi ...	Drigh Road...	4 & 2½	206 0	...	...	.....	.....	.....	...	Failure.

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Bombay Presidency, Poona.

STATEMENT SHOWING PARTICULARS OF EACH DIVISION IN THE WHOLE OF THE PRESIDENCY.

No.	Items.	N. D.	C. D.	S. D.	Poona and Karáchi Districts.	Total.
1	Bores made	99	36	18	6	159
2	Successful	72	25	11	3	111
3	Failures	13	2	4	2	21
4	Incomplete including on hand	14	9	3	1	27
5	Number of machines working	16	7	6	2	31
6	Total depth bored	4,797	2,021	1,446' 11"	588	8,852'-11"
7	Total Cost	20,870 0 9	2,247 3 8	2,528 10 9	397 0 10	26,043 0 0
8	Average number of working days.	274	150	301	163	
9	Percentage of Success	83·72	92·59	73·3	60·00	

Note.—

N. D. includes Ahmedabad, Kaira, Panch Mahals and Broach Districts.
C. D. includes Surat, Thána, Kolába, Násik, Ahmednagar Districts.
S. D. includes Sátára, Sholápur, Bijápur, Dhárwár and Belgaum Districts.

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31	1908	Establishment and Management of the Dairy Farm, by G. K. Kelkar, Assistant Professor of Agriculture (out of print)	
32	1908	Locusts in India, by H. M. Lefroy, Imperial Entomologist, Pusa	0 8 0
33	1909	Cultivation of Broach Cotton in Dharwar, by M. L. Kulkarni, Divisional Inspector of Agriculture, S. D.	0 4 0
,,	,,	,, ,, ,, ,, (Kanarese)	0 4 0
34	1909	Night-soil—A valuable Manure, by G. K. Kelkar, Assistant Professor of Agriculture, Agricultural College, Poona	0 4 0
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38	1910	Experiments with the Water-finder, by H. K. Mehta, Assistant Professor of Physics, &c., Poona Agricultural College (out of print)	
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47	1911	Sann Hemp	0 4 0
48	1911	Poona Furnace	0 7 0
,,	,,	,, ,, (Marathi)	0 6 0
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